

# Index to 1985 NASA Tech Briefs

Volume 10, Numbers 1-4

APRIL 1987

N92-70026

(NASA-TM-105114) INDEX TO 1985 NASA TECH  
BRIEFS, VOLUME 10, NUMBERS 1-4 (NASA)  
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Unclas  
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Z9/85



Electronic Components and Circuits

*SAP \$10.00*



Electronic Systems

*48099*



Physical Sciences

*P-111*



Materials



Computer Programs



Mechanics



Machinery



Fabrication Technology



Mathematics and Information Sciences



Life Sciences

*7N-85-TM*

*NMF NO NTIS*

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# INTRODUCTION

Tech Briefs are short announcements of new technology derived from the research and development activities of the National Aeronautics and Space Administration. These briefs emphasize information considered likely to be transferrable across industrial, regional, or disciplinary lines and are issued to encourage commercial application.

This *Index to NASA Tech Briefs* contains abstracts and four indexes — subject, personal author, originating Center, and Tech Brief Number — for 1985 Tech Briefs.

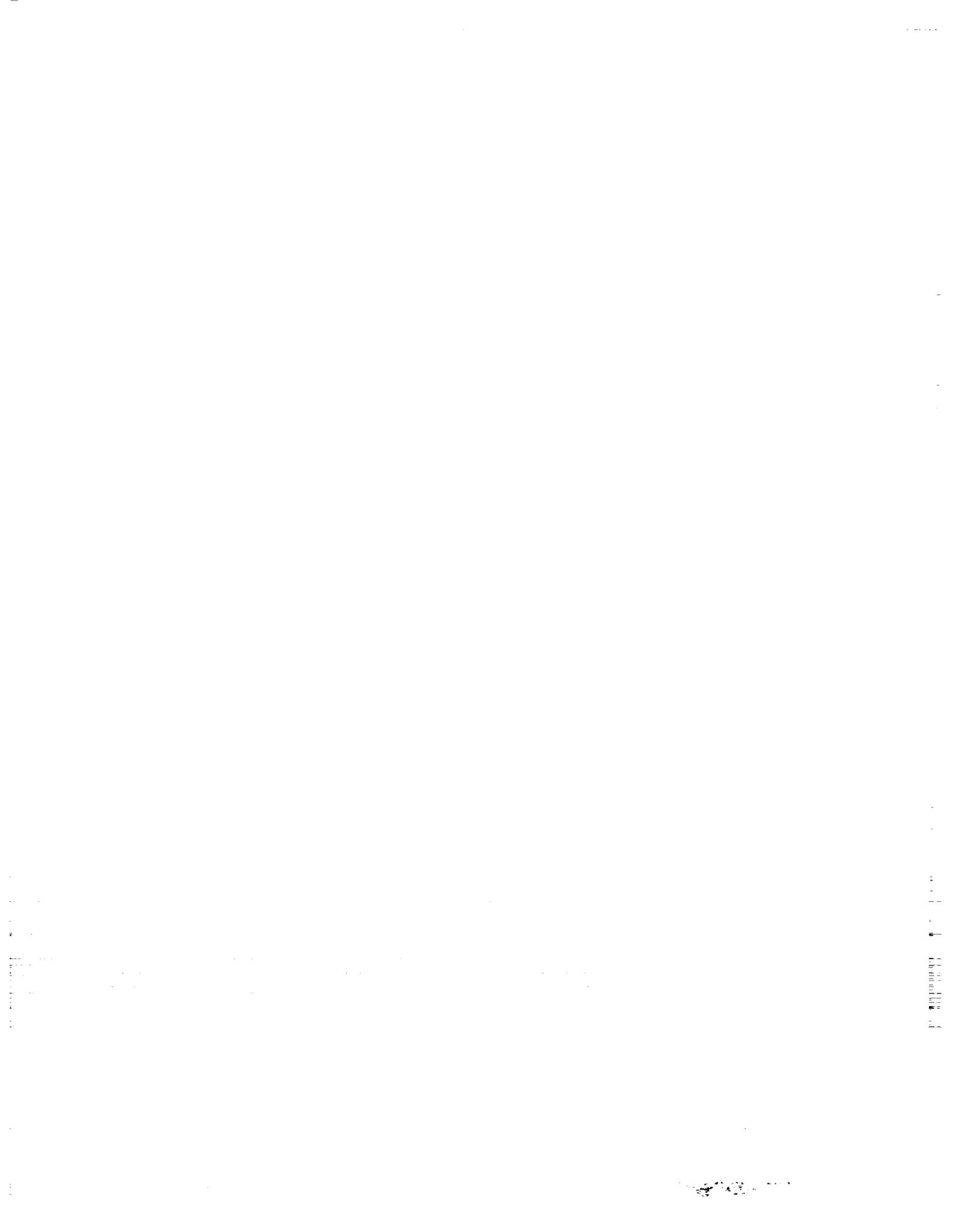
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The January 1985 edition of the *NASA Thesaurus* (NASA SP-7053) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service at \$35.00 for Volume 1 and \$20.00 for Volume 2.



## Originating Center Prefixes

ARC	Ames Research Center
GSC	Goddard Space Flight Center
HQN	NASA Headquarters
KSC	Kennedy Space Center
LAR	Langley Research Center
LEW	Lewis Research Center
MFS	Marshall Space Flight Center
MSC	Johnson Space Center (formerly Manned Spacecraft Center)
NPO	Jet Propulsion Laboratory/NASA Pasadena Office

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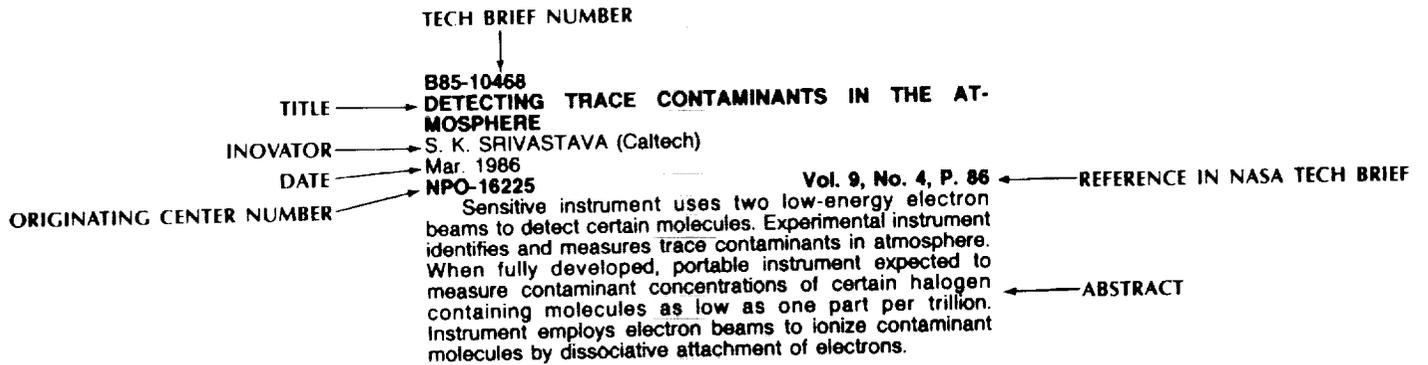
## Abstract Section

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# TYPICAL ABSTRACT ENTRY







# Index to 1985 NASA Tech Briefs

APRIL 1987

## Abstract Section

### 01 ELECTRONIC COMPONENTS AND CIRCUITS

**B85-10001**  
**MEASURING RECOMBINATION VELOCITIES IN SOLAR CELLS**  
O. VONROOS (CALTECH) and K. L. LUKE (CALTECH)  
Jun. 1985

**NPO-16243** Vol. 9, No. 1, P. 36  
Electron-beam scanning method suggested for determining back-surface recombination velocity, SB, of back-surface-field (BSF) solar photovoltaic cell. Recombination velocity important because smaller value correlated with smaller saturation current and therefore higher cell efficiency. Method involves analyzing short-circuit current measured while electron beam scanned along edge of cell.

**B85-10002**  
**HYBRID FIBER-OPTIC/CCD CHIP**  
W. C. GOSS (CALTECH) and J. R. JANESICK (CALTECH)  
Jun. 1985

**NPO-16030** Vol. 9, No. 1, P. 38  
Low noise and linearity of charge-coupled devices (CCD's) combined with optical waveguide components in hybrid, integrated chip package. Concept used to measure laser flux in fiber-gyro application using sensing fibers that range from several to several tens of kilometers in length. Potential applications include optical delay measurement and linear detector of light flux emanating from fiber-optic waveguides.

**B85-10003**  
**DIGITAL HIGH-CURRENT MONITOR**  
B. CASH (Martin Marietta Corporation)  
Jun. 1985

**LAR-13072** Vol. 9, No. 1, P. 39  
Simple technique developed for monitoring direct currents up to several hundred amperes and digitally displaying values directly in current units. Used to monitor current magnitudes beyond range of standard laboratory ammeters, which typically measure 10 to 20 amperes maximum. Technique applicable to any current-monitoring situation.

**B85-10004**  
**IMPROVED THICK DICHROIC REFLECTOR FOR MICROWAVE FEEDS**  
P. D. POTTER (CALTECH)  
Jun. 1985

**NPO-13506** Vol. 9, No. 1, P. 39  
Geometry of reflector plate adjusted to compensate for undesired effects. Design change reduces depolarization

and noise in thick microwave dichroic reflecting plate tilted 30 degrees from orientation broadside to incident beam.

**B85-10005**  
**TILTMETER INDICATES SENSE OF SLOPE**  
J. O. LONBORG (CALTECH)

Jun. 1985  
**NPO-16153** Vol. 9, No. 1, P. 40  
Tiltmeter indicates sense and magnitude of slope used in locations where incline not visible to operator. Use of direct rather than alternating current greatly simplifies design of instrument capable of indicating sense of slope.

**B85-10006**  
**DUAL-MODE HORN ANTENNA FOR MILLIMETER WAVELENGTHS**  
H. M. PICKETT (CALTECH)

Jun. 1985  
**NPO-16297** Vol. 9, No. 1, P. 42  
Millimeter-wave feed horn exhibits nearly equal beam-intensity patterns in E- and H-planes as well as low side-lobe levels. Horn includes circular waveguide step transition, and conical section. Design simplified version of Potter feed-horn design. New feed horn easier to construct, in part because of simpler shape. Reduction in phase change between step transition and aperture increases bandwidth, thereby reducing precision required to manufacture phase-sensitive dimensions of horn.

**B85-10007**  
**FLUX COUPLING FOR WHEELCHAIR BATTERY CHARGERS**

C. W. MCLYMAN (CALTECH)  
Jun. 1985  
**NPO-16269** Vol. 9, No. 1, P. 43  
Battery-charger concept for wheelchairs includes magnetic-flux coupling instead of electrical connections between power sources and wheelchairs. Concept meant to facilitate operation by patients whose disabilities make it difficult or impossible to maneuver common electrical plugs into or out of ac wall outlets.

**B85-10008**  
**SIGNAL PROCESSOR FOR MULTIRATE PSK SIGNALS**  
R. J. HELGESEN (TRW, Inc.)

Jun. 1985  
**MSC-20195** Vol. 9, No. 1, P. 43  
Any of six different data formats at any of five different data rates from phase-shift-key (PSK) modulated input signal extracted by digital radio receiver. Subcarrier Demodulator is Costas loop with hard limiter in inphase arm. There are six low-pass filters, each selectable for rate and format of data to be processed.

**B85-10009**  
**SAW-MODULATED IMAGE DEVICE**

## 01 ELECTRONIC COMPONENTS AND CIRCUITS

H. F. BENZ

Jun. 1985

LAR-12633

Vol. 9, No. 1, P. 44

Imaging device uses surface-acoustic-wave (SAW) charge transfer for image readout. Spatial resolution of image changed electronically by changing frequency of applied signal. Surface acoustic waves create traveling longitudinal electric fields. These fields create potential wells that carry along stored charges. Charges injected into wells by photoelectric conversion when light strikes device.

B85-10010

DAMPING RELAXATION OSCILLATIONS IN LASER DIODES

J. KATZ (CALTECH), A. YARIV (CALTECH), and S. MAR-GAIT (CALTECH)

Jun. 1985

NPO-15980

Vol. 9, No. 1, P. 45

Proposed semiconductor laser modulated at frequencies up to near its resonant frequency more efficiently than older devices. New laser uses two different effective carrier lifetimes: one for dc and lowfrequency operation and another for operation near resonant frequency. Laser part of bipolar transistor with capacitor that serves as ac short circuit.

B85-10011

PROTECTIVE COVER FOR IC PACKAGES

T. J. BORDEN (CALTECH)

Jun. 1985

NPO-15537

Vol. 9, No. 1, P. 46

Aluminized plastic protects integrated circuits from static discharge. Snap-on cover shorts leads of integrated-circuit flatpack to prevent damage from electrostatic discharges during transport, installation, or other handling before final testing. Cover removed only during lead bending and testing.

B85-10012

RECOVERING ENERGY FROM RELAYS

C. W. MCLYMAN (CALTECH)

Jun. 1985

NPO-16268

Vol. 9, No. 1, P. 47

Magnetic energy stored in relay recovered with aid of simple circuit. Circuit recovers more than 20 percent of energy stored in relay winding and returns it to powerline. New three-transistor driver circuit requires no additional winding.

B85-10013

RESISTIVE FINE TUNING OF RESONANT CIRCUIT

C. W. MCLYMAN (CALTECH)

Jun. 1985

NPO-16276

Vol. 9, No. 1, P. 47

Simple fixed-inductance/fixed-capacitance tank circuit modified for fine adjustment of resonant frequency by addition of small inductance with potentiometer across it. Additional winding built into full winding as integral part or added externally. Technique provides quick way of tuning reactance out of power-transformer circuit to maximize power transfer or to adjust frequency of oscillator. Applications include rotary transformers, servo amplifiers, and analog computer modules.

B85-10014

TELEPHONE INSTRUMENT FOR THE DEAF

W. H. BROWN

Jun. 1985

KSC-11303

Vol. 9, No. 1, P. 48

Telephone-communication scheme for deaf uses existing tone-encoded telephone equipment to transmit messages. Only special equipment required is decoder at receiving telephone.

B85-10015

DOUBLE LIGHT-EMITTING DIODE

R. L. JOHNSON (Hughes Aircraft Co.) and T. C. HALL

(Hughes Aircraft Co.)

Jun. 1985

GSC-12832

Vol. 9, No. 1, P. 49

Two GaAs light-emitting diodes packaged as single unit offer greater reliability than conventional single-diode package. One diode is primary light source. If it fails, backup diode switched in. Each diode has separate power lead, so either or both switched on or off at same time.

B85-10016

FAST-RECOVERY, HIGH-VOLTAGE POWER DIODE

G. SUNDBERG, A. BERMAN (Power Transistor Co.), V. BALODIS (Power Transistor Co.), C. GAUGH (Power Transistor Co.), J. DUFFIN (Power Transistor Co.), H. KARATNICKI (Power Transistor Co.), and E. LARSON (Power Transistor Co.)

Jun. 1985 See Also NASA CR-165411 (N81-32382/NSP) and NASA CR-168196 (N84-13443/NSP)

and NASA CR-168196 (N84-13443/NSP)

and NASA CR-168196 (N84-13443/NSP)

and NASA CR-168196 (N84-13443/NSP)

LEW-14036

Vol. 9, No. 1, P. 49

New family of fast-recovery high-voltage power diodes compatible with D60T and D7ST transistors developed. Have wide range of applications in spacecraft and aircraft electrical distribution equipment, dc/dc inverters, and ac motor controllers for high-horsepower electric motors operating from 480-volt ac lines. Fast-Recovery 1,200-V Power Diodes use chip of hexagonal geometry to maximize effective silicon area.

B85-10017

COMPLEMENTARY-LOGIC FAULT DETECTOR

J. C. WAWRZYNEK (CALTECH)

Jun. 1985

NPO-15410

Vol. 9, No. 1, P. 51

Circuit for checking two-line complementary-logic bits for single faults used as building block for self-checking memory interface for Hamming-coded data. Intended for such applications as fault-tolerant computing, data handling, and data transmission. Circuit performs exclusive-OR function. Many such circuits combined produce complete memory interface with both detection and correction abilities.

B85-10018

HIGH-VOLTAGE ISOLATION TRANSFORMER

C. H. CLATTERBUCK and A. P. RUITBERG

Jun. 1985

GSC-12817

Vol. 9, No. 1, P. 52

Arcing and field-included surface erosion reduced by electrostatic shields around windings and ferromagnetic core of 80-kilovolt isolation transformer. Fabricated from high-resistivity polyurethane-based material brushed on critical surfaces, shields maintained at approximately half potential difference of windings.

B85-10019

FAST CLOCK RECOVERY FOR DIGITAL COMMUNICATIONS

R. G. TELL (CALTECH)

Jun. 1985

NPO-16083

Vol. 9, No. 1, P. 53

Circuit extracts clock signal from random non-return-to-zero data stream, locking onto clock within one bit period at 1-gigabit-per-second data rate. Circuit used for synchronization in optical fiber communications. Derives speed from very short response time of gallium arsenide metal/semiconductor field-effect transistors (MESFET's).

B85-10020

AIRCRAFT CONTROL-POSITION INDICATOR

D. V. DENNIS (Kentron International, Inc.)

Jun. 1985

LAR-12984

Vol. 9, No. 1, P. 54

Aircraft control-position indicator cockpit-mounted instrument that displays positions of elevator and ailerons to pilot. Display is cruciform array of lights: horizontal row of amber lights and vertical row of green lights representing aileron and elevator positions, respectively. Display used

## 01 ELECTRONIC COMPONENTS AND CIRCUITS

extensively in spin testing and has been trouble-free, with no maintenance required after about 30 hours of operation.

### **B85-10021** **SOLAR CELLS WITH MULTIPLE SMALL JUNCTIONS** T. DAUD (CALTECH) and K. M. KOLIWAD (CALTECH)

Jun. 1985  
NPO-16126 Vol. 9, No. 1, P. 55

Concept for improving efficiency of photovoltaic solar cells based on decreasing p/n junction area in relation to total surface area of cell. Because of reduced junction area, surface leakage drops and saturation current density decreases. Surface passivation helps to ensure short-circuit current remains at high value and response of cells to blue light increases.

### **B85-10022** **LOWERING AMMETER INPUT IMPEDANCE** C. M. SIEGEL (University of Virginia)

Jun. 1985  
NPO-16067 Vol. 9, No. 1, P. 55

Feedback circuit operates in conjunction with sensitive microammeter or other current-measuring instrument to reduce input impedance of composite circuit. In contrast with older current-amplifier circuits, current much less subject to drift and noise, calibration not necessary, and values of components not critical.

### **B85-10023** **INFRARED LINEAR IMAGING ARRAY** G. C. BAILEY (CALTECH)

Jun. 1985  
NPO-15805 Vol. 9, No. 1, P. 56

Photodiodes, multiplexer, and preamp reside in hybrid ceramic package. Hybrid microcircuit produces 128-element line images of infrared scenes. Each picture element is 0.008-in. (0.2-mm) square. Even without image data processing, microcircuit resolves temperature differences as small as 0.05 degrees C in infrared images.

### **B85-10024** **POWER-FACTOR CONTROLLERS: HOW SAFE?** K. LONG (Underwriters Laboratories, Inc.), W. CHRISTIAN (Underwriters Laboratories, Inc.), J. KOVACIK (Underwriters Laboratories, Inc.), and T. GRAZYK (Underwriters Laboratories, Inc.)

Jun. 1985  
MFS-27016 Vol. 9, No. 1, P. 57

Potential safety problems with power-factor controllers (PFC's) evaluated. Based on study of PFCs in use with appliances, report recommends measures to prevent consumers from misapplying these energy saving devices. Device used on such appliances as refrigerators, sewing machines, pumps, hair dryers, and food processors. When misused, they fail to save energy and may cause damage.

### **B85-10025** **PHOTOVOLTAICS IN JAPAN** K. SHIMADA (CALTECH)

Jun. 1985  
NPO-16330 Vol. 9, No. 1, P. 57

Report surveys status of research and development on photovoltaics in Japan. Report based on literature searches, private communications, and visits by author to Japanese facilities. Included in survey are Sunshine Project, national program to develop energy sources; industrial development at private firms; and work at academic institutions.

### **B85-10140** **FERRORESONANT CIRCUIT WITH INCREASED EFFICIENCY** C. W. T. MCLYMAN (Caltech)

Aug. 1985  
NPO-16326 Vol. 9, No. 2, P. 30

Additional inductor reduces heating and increases stability. In modified circuit small inductor in series with

capacitor reduces criticality of tuning. Broadens commutating interval but decreases peak commutating current sufficiently to reduce net heating over complete cycle.

### **B85-10141** **POWER SUPPLY FOR 25-WATT ARC LAMP** B. D. LEIGHTY

Aug. 1985  
LAR-13202 Vol. 9, No. 2, P. 32

Dual-voltage circuitry both strikes and maintains arc. New power supply designed (and several units already in use) that replaces relay/choke combination with solid-state starter. New power supply consists of two main sections. First section (low voltage power supply section) is 84-volt directcurrent supply. Second section (high-voltage starter circuit) is Cockcroft-Walton voltage multiplier. Used as light sources for schlieren, shadowgraph, and other flow-visualization techniques.

### **B85-10142** **PORTABLE TEMPERATURE SET-POINT CONTROLLER** J. F. MILNER (Rockwell International Corp.)

Aug. 1985  
MSC-20056 Vol. 9, No. 3, P. 35

Two off-the-shelf instruments combine to control chamber temperature over wide range. Portable controller for environmental test chambers changes temperatures automatically over range of -300 degrees to +400 degrees F (-184 degrees to +204 degrees C). Unit controls rate of temperature change and time at given temperature. Controller developed to meet NASA Shuttle test requirements.

### **B85-10143** **RECHARGING BATTERIES CHEMICALLY** R. M. WILLIAMS (Caltech), J. ROWLETTE (Caltech), and J. GRAF (Caltech)

Aug. 1985  
NPO-16024 Vol. 9, No. 2, P. 35

Iron/air batteries recharged chemically by solution of strong base in alcohol or by basic alcohol solution of reducing agent. Although method still experimental, it has potential for batteries in electric automobiles or as energy system in remote applications. Also used in quiet operations where noise or infrared signature of diesel engine is not desired.

### **B85-10144** **ROLLING-CONTACT RHEOSTAT** C. F. RUOFF (Caltech)

Aug. 1985  
NPO-15567 Vol. 9, No. 2, P. 36

Contact noise in rheostats and potentiometers reduced by rolling contact design. Smooth rolling action eliminates sporadic variations in resistance caused by bouncing and stick/slip motion of conventional sliding contacts.

### **B85-10145** **INCREMENTALLY VARIABLE HIGH-VOLTAGE SUPPLY** D. W. POTTER (University of Washington), J. CHIN (University of Washington), H. R. ANDERSON (Science Applications, Inc.), and R. L. LOVELESS (Science Applications, Inc.)

Oct. 1985  
MFS-28018 Vol. 9, No. 2, P. 38

Programmable power supply provides regulated output ranging from 2.5 to 2,500 volts. Exponential digital-to-analog converter provides low-voltage analog signal to power converter and to negative and positive high-voltage regulators. In response, converter furnishes voltage of approximate magnitude represented by analog signal, and regulators adjust voltage to precise magnitude. Entire voltage range covered in 169 steps. Total power consumption expected to be less than 2 watts.

### **B85-10146** **LOW-VOLTAGE PROTECTION FOR VOLATILE COM-**

## 01 ELECTRONIC COMPONENTS AND CIRCUITS

### PUTER MEMORIES

R. C. DETWILER (Caltech)

Aug. 1985

NPO-15909

Vol. 9, No. 2, P. 42

Short-circuit current provides minimum memory power. Protective circuit includes dc-to-dc converter that supplies keep-alive voltage to memories when short circuit occurs in any of system loads. Converter powered by low-voltage across two of three series diodes generated by short-circuit bus current. Relay switch is in open (short-circuit-detected) position. Protective circuit useful wherever necessary to improve reliability of volatile memories or other circuits that must not lose power.

B85-10147

### COMPARATOR WITH NOISE SUPPRESSION

C. N. BATTS

Aug. 1985

LAR-13151

Vol. 9, No. 2, P. 43

Comparator continuously and automatically adjusts noise immunity period. High-gain amplifier used in conjunction with multivibrator 4 to provide clear pulse to multivibrator 1 at first negative-going zero crossing of input signal. Once multivibrator 1 cleared, output goes to zero volts and not retriggered until next time positive input exceeds reference level. Since input signal noise at zero crossing does not exceed reference level, no effect on multivibrator 1 operation. Circuit fabricated using standard solid-state operational amplifiers, multivibrators, OR gates, and passive elements.

B85-10148

### REMOTE POWER CONTROLLERS FOR HIGH-POWER DC SWITCHING

J. C. STURMAN

Aug. 1985

LEW-14109

Vol. 9, No. 2, P. 44

Circuits combine functions of remotely controlled switch and circuit breaker. Circuits developed at different power levels but conceptually very similar. Selection of appropriate switching devices and minor modifications, circuits used to build RPC's covering range of voltage and power levels limited only by switching devices chosen. RPC's using GTO's have power capability ranging from 7.8 to 52 kW, while those using MOSFET's range from 8 to 15 kW. Applications include satellite, Space Station, commercial aircraft, naval vessels, and numerous industrial areas.

B85-10149

### HIGH-OUTPUT INJECTION LASER

J. C. CONNOLLY (RCA Laboratories) and D. BOTEZ (RCA Laboratories)

Aug. 1985

LAR-13213

Vol. 9, No. 2, P. 45

Terraced double-heterojunction large optical cavity laser features high output in single optical mode. Semiconductor laser consists of body of single-crystal semiconductor material, typically composed of Group III to V compounds in form of rectangular parallelepiped. One of laser end faces partially transparent so that light may be emitted from it. Lateral thickness variation of active and guide layers in semiconductor laser produces confinement of propagating laser beam in lateral direction.

B85-10150

### COMMUTATING PERMANENT-MAGNET MOTORS AT LOW SPEED

C. DOLLAND (AiResearch Manufacturing Co.)

Aug. 1985

MFS-25207

Vol. 9, No. 2, P. 46

Circuit provides forced commutation during starting. Forced commutation circuit diverts current from inverter SCR's and turns SCR's off during commutation intervals. Silicon controlled rectifier in circuit unnecessary when switch S10 replaced by high-current, high-voltage transistor. At present, high-current, low-voltage device must suffice.

B85-10151

### REMOTELY-ADJUSTABLE SOLID-STATE HIGH-VOLTAGE SUPPLY

W. T. SIMMS (Caltech)

Oct. 1985

NPO-15719

Vol. 9, No. 2, P. 48

Pulsed or steady outputs up to 20 kV produced by commercial components. Circuit produces adjustable high-voltage output in response to low-voltage input. Output voltage changes approximately linearly up to 20 kilovolts as input voltage varied from 0 to 5 volts. Output steady, or sine wave varied at rates up to 100 pulses per second. Output current about 100 microamperes. Reduction in output-filter capacitance confers additional benefit by reducing pulse rise time.

B85-10152

### REED-SWITCH POSITION INDICATOR

F. E. WINNER (Martin Marietta Corp.)

Oct. 1985

KSC-11215

Vol. 9, No. 2, P. 49

Indicator for valves or other control mechanisms easy to mount, reliable, and explosion proof. Replaces slidewires expensive and difficult to mount. Used in hazardous areas that require nonexplosive electrical contacts, and controlling highly flammable fuels. Readily adapted to oil-refining and other chemical processing plants.

B85-10153

### RETRODIRECTIVE-OPTICAL-TRANSPONDER CONCEPT

R. M. DICKINSON (Caltech)

Aug. 1985

NPO-16315

Vol. 9, No. 2, P. 50

Pointing errors and optical imperfections automatically corrected. Coherent optical transponder employs nearly-degenerate four-wave mixing in nonlinear optical element to produce signal traveling back toward source of incoming signal. Return signal modulated for communication, navigation, data transmission, tracking, and identification. When perfected concept finds important civilian and military applications in line-of-sight tracking, communication and identification.

B85-10154

### ELECTRICALLY CONNECTING TO PRESSURE VESSELS

P. J. ROSSI (Rockwell International Corp.)

Oct. 1985

MSC-20709

Vol. 9, No. 2, P. 51

Resilient conductive disk eliminates need for holes in vessel walls. Grounding disk made from wire and solder and sandwiched between electrical-component support and pressure-vessel wall. Emplaced in component support, disk squeezed to 66 percent of its thickness. Disk conforms to surfaces of support and vessel wall when support attached to wall with adhesive. Disk thus forms reliable electrical contact from support (and its electrical component) to wall.

B85-10155

### ORIENTING ARC LAMPS FOR LONGEST LIFE

J. KISS (ILC Technology, Inc.)

Oct. 1985

MSC-20562

Vol. 9, No. 2, P. 51

Temperature distribution strongly affects performance. Tests on floodlights for Space Shuttle payload bay show useful life of metal halide dc arc lamp prolonged by mounting 'anode down' and wiring for maximum heat conduction away from electrodes. Anode-down configuration, anode and cathode temperatures stabilize at 333 degrees and 313 degrees C, respectively, after 1 hour of operation. Temperatures both below limit for quartz-to-metal seals, and lamps able to withstand a 2,000-hour life test with satisfactory light output at end.

B85-10156

### ROTARY POWER TRANSFORMER AND INVERTER CIRCUIT

C. W. T. MCLYMAN (Caltech) and A. O. BRIDGEFORTH (Caltech)  
Oct. 1985  
NPO-16270

Vol. 9, No. 2, P. 52

Noise lower than with sliprings. Rotary transformer transfers electric power across rotary joint. No wearing contacts, no contact noise, and no contamination from lubricants or wear debris. Because additional inductor not required, size and complexity of circuit reduced considerably.

B85-10157  
PULSE-WIDTH-TO-ANALOG-VOLTAGE CONVERTER  
G. S. SOSACK (Rockwell International Corp.) and N. E. SIMMONS (Rockwell International Corp.)  
Oct. 1985

Vol. 9, No. 2, P. 53

MSC-20006  
Peak output voltage varies linearly with input-pulse duration. Circuit converts pulses of varying widths (as from sound-velocity instrumentation or tachometers) into analog voltages. Peak voltage increases in proportion to pulse width. Voltage used to drive an x-y plotter or storage oscilloscope. Pulse-width-to-voltage converter has peak output voltage that varies with duration of input pulses.

B85-10158  
MODELING 'SOFT' ERRORS IN BIPOLAR INTEGRATED CIRCUITS  
J. ZOUTENDYK (Caltech), R. BENUMOF (Caltech), and O. VONROOS (Caltech)  
Oct. 1985

NPO-16375; NPO-16384; NPO-16293 Vol. 9, No. 2, P. 54

Mathematical models represent single-event upset in bipolar memory chips. Physics of single-event upset in integrated circuits discussed in theoretical paper. Pair of companion reports present mathematical models to predict critical charges for producing single-event upset in bipolar randomaccess memory (RAM) chips.

B85-10159  
STUDY OF CONTACT RESISTANCES IN INTEGRATED CIRCUITS  
M. G. BUEHLER (Caltech), J. LAMBE (Caltech), and S. F. SUSZKO (Caltech)  
Oct. 1985

NPO-16248 Vol. 9, No. 2, P. 55

Techniques explored in search for rapid, reliable test. Resistances of aluminum/silicon contacts and methods to measure subjects of NASA report. Study with three tasks undertaken to evaluate nature and reliability of large numbers of semiconductor contacts of type now being fabricated in integrated circuits: Develop yield analysis for series strings of contacts using wafer-level electrical measurements, and identify different types of faults by visual inspection; develop wafer-level tests to evaluate reliability of contact strings; and develop mathematical model for current flow in contacts and examine contact region for evidence of micro-alloying.

B85-10288  
POLARIZING FILTER FOR INTEGRATED OPTICS  
O. G. RAMER (Hughes Aircraft Co.), W. C. GOSS (Caltech), and R. GOLDSTEIN (Caltech)  
Jan. 1986

NPO-16429 Vol. 9, No. 3, P. 36

Polarizing filter for titanium-doped lithium niobate light waveguide suppresses transverse magnetic (TM) mode of light propagation while allowing transverse electric (TE) mode to continue on its way. Filter - lithium niobate crystal - is expected to find many applications in integrated optical circuits.

B85-10289  
SMOOTHLY ADJUSTABLE DC LOAD  
C. G. PATOCKA (Rockwell International Corp.)  
Jan. 1986  
MSC-20853

Vol. 9, No. 3, P. 39

Load circuit for testing dc power supplies adjusted without momentary interruptions typical of rheostat loads. Load current passes through power transistor and fixed resistor instead of wire-wound rheostat. In new circuit potentiometer used to adjust bias of power transistor and thereby adjust load. Components are standard, commercially available parts, mounted on transistor heat sink, forming compact package.

B85-10290  
FIBER-OPTIC ELECTRIC-FIELD METER  
A. R. JOHNSTON (Caltech)  
Jan. 1986

NPO-16435 Vol. 9, No. 3, P. 39

Sensor for measuring electric-field strength does not greatly alter field in which placed. Sensor used to map fields in electric power substation or under high-voltage transmission line. Also used for laboratory measurements. Fused-silica fibers guide light from source to photometer. Light emerges from tip of source fiber, passes through curved coupler, and enters tip of photometer fiber. Attenuation of coupler changes with distance between fiber tips.

B85-10291  
EFFICIENT POWER AMPLIFIER FOR MOTOR CONTROL  
R. J. BROWN (Navtrol Co.)  
Jan. 1986

GSC-12807 Vol. 9, No. 3, P. 40

Pulse-width-modulated amplifier supplies high current as efficiently as low current needed for starting and running motor. Key to efficiency of motor-control amplifier is V-channel metal-oxide/semiconductor transistor Q1. Device has low saturation resistance. However, has large gate input capacitance and small margin between its turn-on voltage and maximum allowable gate-to-source voltage. Circuits for output stages overcome limitations of VMOS device.

B85-10292  
PLUG-IN RF SELECTOR SWITCH  
A. H. HWON (Transco Product, Inc.) and C. F. STEIDEL (Transco Product, Inc.)  
Jan. 1986

MSC-20572 Vol. 9, No. 3, P. 41

Short, direct link between switch and filters reduces signal loss. New switch attaches directly to filter housing, eliminating cables and connectors. As result, losses in transmitter and receiver paths reduced by about 0.4 dB. Because connectors and cables are not used, RF path loss for selected signal through switch and filter is smaller than usual.

B85-10293  
REMOVING HEAT FROM TOROIDAL INDUCTORS  
C. W. T. MCLYMAN (Caltech)  
Jan. 1986

NPO-16386 Vol. 9, No. 3, P. 41

Bracket for mounting toroidal inductors adapted for removing heat and providing support. Copper windings wound around bracket instead of directly on core. Heat-dissipating mounting bracket encircles hollow cylindrical magnetic core. Core wrapped with toroidal winding and encapsulated in usual way. Bracket provides direct path for heat to leave both core and windings.

B85-10294  
ATTACHING AN ELECTRICAL GROUND TO AN ALUMINUM STRUCTURE  
K. L. BILLINGTON (Rockwell International Corp.)  
Jan. 1986

MSC-20668 Vol. 9, No. 3, P. 45

Method for creating low-resistance groundpath from electronic equipment to aluminum supporting structure requires no drilling or other penetration of structure. Method does not require costly silver-filled adhesive used previously. Ground connection is light weight, requires few parts,

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and not subject to galvanic corrosion. Placed at any convenient location on structure so interference with adjacent parts avoided.

**B85-10295**

### **TOUCH SENSOR FOR ROBOTS**

H. C. PRIMUS (Caltech)

Jan. 1986

**NPO-16230**

**Vol. 9, No. 3, P. 46**

Touch sensor for robot hands provides information about shape of grasped object and force exerted by gripper on object. Pins projecting from sensor create electrical signals when pressed. When grasped object depresses pin, it contacts electrode under it, connecting electrode to common electrode. Sensor indicates where, and how firmly, gripper has touched object.

**B85-10296**

### **PREVENTING ELECTROSTATIC-DISCHARGE DAMAGE TO ELECTRONICS**

W. S. READ (Caltech), P. C. DOZOIS (Caltech), and J. O. LONBORG (Caltech)

Jan. 1986

**NPO-15953**

**Vol. 9, No. 3, P. 46**

Booklet discusses damage to electronic components caused by electrostatic discharges during assembly. Describes procedure for setting up static-free workplace for handling and assembling electronic components.

**B85-10297**

### **SINGLE-EVENT-UPSET STUDIES: A COMPILATION**

D. K. NICHOLS (Caltech), W. E. PRICE (Caltech), C. J. MALONE (Caltech), and L. S. SMITH (Caltech)

Jan. 1986

**NPO-16362**

**Vol. 9, No. 3, P. 48**

Document summarizes 15 studies of single-event upsets covering 60 different types of semiconductor devices. Studies discussed in document include verification of basic reactions induced by heavy ions and protons and surveys of latchup and bit-flip susceptibility of several types of devices and device-fabrication technologies.

**B85-10298**

### **OPTIMIZING A LINEAR ARRAY OF RADIATING ELEMENTS**

S. J. BLANK (Caltech)

Jan. 1986

**NPO-16352**

**Vol. 9, No. 3, P. 49**

EOPS empirically optimizes linear array of radiating elements. Program directly addresses problem of minimizing maximum side-lobe level of fixed length, linear arrays of radiating elements under realistic 'on-the-vehicle' conditions. Used for both electromagnetic and acoustic arrays.

**B85-10299**

### **OPTIMIZATION OF ANTENNA-STRUCTURE DESIGN**

R. LEVY (Caltech)

Jan. 1986

**NPO-16158**

**Vol. 9, No. 3, P. 50**

Conference paper describes application of optimality criterion to design of microwave dish antenna. For purpose of study, overall design objective is to minimize structural weight, subject to design constraints that antenna-pointing and microwave-path-length errors not exceed specified values. Design constraints and optimality criterion satisfied in same procedure.

**B85-10300**

### **CONNECTORS AND WIRING FOR CRYOGENIC TEMPERATURES**

R. D. TURNER

Jan. 1986

**LAR-13193**

**Vol. 9, No. 3, P. 50**

Tests performed at Langley Research Center to find connectors, cables, and other electrical components suitable for use in cryogenic environment described. In addition,

several electrical cables have to flex under cryogenic conditions. Tests necessary to qualify materials for use in National Transonic Facility (NTF), which operates at temperature range from 175 degrees to -300 degrees F (353 to 89 K).

**B85-10428**

### **PULSE COUPLING FOR LASER EXCITATION**

T. J. PACALA (Caltech)

Mar. 1986

**NPO-16403**

**Vol. 9, No. 4, P. 40**

Tapered transmission line couples energy from magnetic switch to excimer laser. Transmission line provides constant impedance for pulses from switch and distributes pulses across length of laser as nearly uniform wave fronts. Allows smaller, more efficient magnetic core to be used in switch. Losses and circuit capacitance are less than for full-laser-width line and core.

**B85-10429**

### **GENERATING INDEPENDENT PREIONIZING PULSES FOR LASERS**

T. J. PACALA (Caltech)

Mar. 1986

**NPO-16402**

**Vol. 9, No. 4, P. 42**

Simple pulse-coupling winding on saturable reactor core lets core act as pulse transformer, passing preionizing pulse from winding to tapered transmission line, then to laser. Laser prepared for independent firing pulse, which follows preionizing pulse. Winding is simple, light in weight, low in bulk and power consumption, and inexpensive.

**B85-10430**

### **MAGNETICALLY-SWITCHED, LONG-PULSE XECL LASER**

T. J. PACALA (Caltech), I. S. MCDERMID (Caltech), and J. B. LAUDENSLAGER (Caltech)

Mar. 1986

**NPO-16410**

**Vol. 9, No. 4, P. 42**

Careful shaping of input pulses helps XeCl excimer laser produce low-divergence, narrow-band light beam. Long-pulse laser achieves narrow-band output by multiple passes of beam through precisely adjusted Fabry-Perot etalons. Pulse-forming network and saturable-inductor switch enable fast pulse rise to peak voltage, followed by long residence at peak.

**B85-10431**

### **OBTAINING ONE-DEGREE ACCURACY WITH SHAFT ENCODERS**

J. M. FRANKE, J. I. CLEMMONS, and S. B. JONES

Mar. 1986

**LAR-13321**

**Vol. 9, No. 4, P. 44**

Circuit converts output of 1-pulse-per-revolution shaft encoder to precise 360-pulses-per-revolution output. Circuit allows shaft angular position to be measured with 1-degree accuracy. With simple modifications, circuit provides higher or lower resolution from single- or multiple-pulse-per-revolution sources. Circuit used to synchronize aircraft beacon transponder-based plan-position indicator (PPI) display to remote host interrogator search antenna. Constructed using standard, commercially available components.

**B85-10432**

### **MICROWAVE POWER COMBINER WITH SWITCHING DIODES**

B. L. CONROY (Caltech), R. B. POSTAL (Caltech), and J. F. BOREHAM (Caltech)

Mar. 1986

**NPO-15775**

**Vol. 9, No. 4, P. 46**

In multiple-port microwave power combiner, each of outputs of two or more power amplifiers of same frequency and phase passed to common output port separately or together. Each amplifier connected to combiner through switch consisting of resonant structures, radio-frequency chokes, and diode. Switches not only permit flexibility in

## 01 ELECTRONIC COMPONENTS AND CIRCUITS

selection of amplifiers but isolate unused amplifiers from network, all while operating at relatively low power loss.

**B85-10433**  
**CASSEGRAIN-ANTENNA GAIN IMPROVEMENT**  
 V. GALINDO (Caltech), A. G. CHA (Caltech), and R. MITTRA (University of Illinois)

Mar. 1986  
**NPO-15775** Vol. 9, No. 4, P. 48

Modified antenna feed with dual-shaped subreflectors yields 10-to20-percent improvement in efficiency of existing large-aperture paraboloidal or Cassegrainian antennas. Such offset dual-shaped subreflector (DSS) feed brings gain of existing paraboloid or Cassegrain antennas up to that of reflector antennas of more recent design at cost considerably lower than for reshaping existing reflecting surfaces. Mathematical procedures developed for synthesizing nearly optimum shapes for DSS elements of new feeds.

**B85-10434**  
**MULTIPLE-WINDING OUTPUT INDUCTORS FOR POWER CONVERTERS**

C. W. T. MCLYMAN (Caltech)

Mar. 1986  
**NPO-16176** Vol. 9, No. 4, P. 49

Design procedure developed for dc-to-dc power converters with multiple outputs having inductors wound on common core. With common core, minimum load current consistent with good output regulation is lower, output regulation is improved, and total inductor size and weight is reduced.

**B85-10435**  
**IMPROVED WAVEGUIDE LASER ARRAY**

S. MUKAI (Caltech), C. P. LINDSEY (Caltech), J. KATZ (Caltech), E. KAPON (Caltech), A. YARIV (Caltech), and S. MARGALIT (Caltech)

Mar. 1986  
**NPO-16500** Vol. 9, No. 4, P. 49

Improved structure for integrated array of Al<sub>x</sub>Ga<sub>1-x</sub>As diode lasers causes array to oscillate predominantly in fundamental supermode (with all units at same phase), thereby producing intense, narrow light beam. New structure differs from older ones in that gain in spaces between laser channels is approximately equal to gain in channels.

**B85-10436**  
**A QUICK VISUAL POWER-SUPPLY MONITOR**

L. W. TAYLOR (The Johns Hopkins University)

Mar. 1986  
**MFS-26014** Vol. 9, No. 4, P. 50

Power-supply voltages quickly monitored by circuit equipped with light-emitting-diode (LED) display. Operator looking at display quickly spots whether power output voltage is above, below, or within acceptable limits. Tricolor LED displays high, low, and intermediate output voltages.

**B85-10437**  
**CONTROLLING TRANSISTOR TEMPERATURE DURING BURN-IN**

B. C. SCOTT (Martin Marietta Corp.)

Mar. 1986  
**MFS-28076** Vol. 9, No. 4, P. 52

Boiling refrigerant provides simple temperature control for newly manufactured power transistors. Heat-transfer liquid is Fluorinert FC-77 (or equivalent). Liquid boils at 100 degrees C, which is specified temperature at which transistor cases should be maintained during burn-in with this technique.

**B85-10438**  
**KEYBOARD WITH VOICE OUTPUT**

W. C. HUBER

Mar. 1986  
**MSC-20869** Vol. 9, No. 4, P. 54

Voice synthesizer tells what key is about to be de-

pressed. Verbal feedback useful for blind operators or where dim light prevents sighted operator from seeing keyboard. Also used where operator is busy observing other things while keying data into control system. Used as training aid for touch typing, and to train blind operators to use both standard and braille keyboards. Concept adapted to such equipment as typewriters, computers, calculators, telephones, cash registers, and on/off controls.

**B85-10439**  
**CONDUCTIVE CONTAINER FOR SEMICONDUCTOR DEVICES**

J. T. RICE (Caltech)

Mar. 1986  
**NPO-16110** Vol. 9, No. 4, P. 54

Container for semiconductor components not only protects them against mechanical damage but ensures they are not harmed by electrostatic discharges. Container holds components in fixed positions so they can be serialized and identified from their locations. Suitable for holding components during both storing and shipping. Originally developed for microwave diodes, container concept readily adaptable to transistors and integrated circuits.

**B85-10440**  
**LOW-COST HUMIDITY SENSOR**

E. G. LAUE (Caltech)

Mar. 1986  
**NPO-16544** Vol. 9, No. 4, P. 55

Electronic humidity sensor is simple, inexpensive, and produces output readily used by indicator or control circuits. Sensor operates at safe, low voltage and is relatively invulnerable to electrolysis effects. Sensor used to measure humidity in atmosphere, in soil, and industrial gases, for example.

**B85-10441**  
**FLOATING-EMITTER SOLAR-CELL TRANSISTOR**

C. T. SAH (Caltech) and L. J. CHENG (Caltech)

Mar. 1986  
**NPO-16467** Vol. 9, No. 4, P. 56

Conceptual transistor embedded in photovoltaic diode promises to increase efficiency to more than 20 percent. Solar-cell transistor has front-surface contact, rear contact, and floating emitter. Variety of other contact and junction configurations possible, but do not offer ease of fabrication in combination with high performance.

**B85-10442**  
**TESTER FOR DISTRESS BEACONS**

W. R. WADE (Proteon, Inc.)

Mar. 1986  
**GSC-12892** Vol. 9, No. 4, P. 56

Distress beacons on aircraft and boats checked for proper operation with aid of onboard monitor. Monitor mounted in aircraft cockpit or at wheel of boat. Connected to beacon electronics by cable. Monitor used with interface circuitry in beacon, which acts as buffer so that operation of beacon is not adversely affected if monitor is removed or if connecting cable is accidentally short circuited.

**B85-10443**  
**CONTROL ELECTRONICS FOR SOLAR/FLYWHEEL POWER SUPPLY**

F. J. NOLA

Mar. 1986  
**MFS-25978** Vol. 9, No. 4, P. 57

Control circuit automatically directs flow of electrical energy to and from motor with flywheel that constitutes storage element of solar-power system. When insolation is sufficient for charging, power is supplied by solar-cell array to load and motor. During periods of darkness, motor made to act as generator, drawing kinetic energy from flywheel and supplying it to load.

## 01 ELECTRONIC COMPONENTS AND CIRCUITS

**B85-10444**

### **REDUCED-STRESS MOUNTING FOR THERMOCOUPLES**

C. WOOD (Caltech)

Mar. 1986

**NPO-16513**

**Vol. 9, No. 4, P. 58**

Mounting accommodates widely different coefficients of thermal expansion. In new method, legs of thermocouple placed in separate n- and p-type arrays. Two arrays contact common heat pipe as source but have separate heatpipe sinks. Net expansion (or contraction) taken up by spring mounting on heat-pipe sinks.

**B85-10445**

### **DETERMINING INTERNAL CONNECTIONS IN CAPACITORS**

F. M. OTT (Caltech) and M. F. HANNA (Caltech)

Mar. 1986

**NPO-16499**

**Vol. 9, No. 4, P. 60**

Simple electrical test shows which terminals connected to outer capacitor foil. Test makes it unnecessary to resort to X-ray inspection to distinguish terminals. When outer foil of capacitor is attached to ungrounded signal-generator output lead, oscilloscope displays higher waveform amplitude. When outer foil is joined to grounded signal-generator output lead, waveform amplitude is lower. Test also used to determine internal connections in multiple-element capacitors.

**B85-10446**

### **ACCELERATING CORROSION IN SOLAR-CELL TESTS**

H. M. SHALABY (Caltech)

Mar. 1986

**NPO-16096**

**Vol. 9, No. 4, P. 60**

In simple electrochemical cell, two silicon solar cells serve as anode and cathode, respectively. Electrolytic medium and voltage between them accelerate corrosion and migration interactions between cell metal contacts and plastic encapsulant. Degradation of metal contacts becomes evident in few hours. Although developed specifically for cells with Ti/Pd/Ag contacts, technique readily adapted to other metal combinations.

television monitor. System also extracts digital portion of stored information and transfers it to solid-state memory.

**B85-10028**

### **HIGH-SPEED COMPUTER-CONTROLLED SWITCH-MATRIX SYSTEM**

E. SPISZ, B. CORY (General Electric Co.), P. HO (Ford Motor Co.), and M. HOFFMAN (Mitre Corp.)

Jun. 1985 NASA CR-159682 (N80-12260/NSP) and NASA CR-168089 (N83-34998/NSP)

**LEW-14050**

**Vol. 9, No. 1, P. 60**

High-speed computer-controlled switch-matrix system developed for communication satellites. Satellite system controlled by onboard computer and all message-routing functions between uplink and downlink beams handled by newly developed switch-matrix system. Message requires only 2-microsecond interconnect period, repeated every millisecond.

**B85-10029**

### **LOW-COST TELECONFERENCE SYSTEM**

R. F. RICE (CALTECH) and A. P. SCHLUTSMAYER (CALTECH)

Jun. 1985

**NPO-16057**

**Vol. 9, No. 1, P. 61**

Proposed video teleconferencing system displays drawings, photographs, and text for conferees. Although new system, called TELEDEMO, does not present live scenes from conference locations, it cost far less than conventional teleconference services. Widely scattered participants communicate by voice, graphics, and images over telephone lines.

**B85-10030**

### **DYNAMIC-RAM DATA STORAGE UNIT**

J. C. STURMAN

Jun. 1985

**LEW-14017**

**Vol. 9, No. 1, P. 62**

Dynamic random-access-memory (RAM) data delay and storage unit developed to insure data received from satellite is stored and not lost when satellite is not within range of ground station. Stores 256K of serial data, with independent read and write capability.

**B85-10031**

### **REDUNDANT ASYNCHRONOUS MICROPROCESSOR SYSTEM**

G. MEYER, J. O. JOHNSTON, and W. R. DUNN (University of Southern Colorado)

Jun. 1985

**ARC-11348**

**Vol. 9, No. 1, P. 63**

Fault-tolerant computer structure called RAMPS (for redundant asynchronous microprocessor system) has simplicity of static redundancy but offers intermittent-fault handling ability of complex, dynamically redundant systems. New structure useful wherever several microprocessors are employed for control - in aircraft, industrial processes, robotics, and automatic machining, for example.

**B85-10032**

### **DESIGNING TEST CHIPS FOR CUSTOM INTEGRATED CIRCUITS**

M. G. BUEHLER (CALTECH), T. W. GRISWOLD (CALTECH), C. A. PINA (CALTECH), and C. C. TIMOC (CALTECH)

Jun. 1985

**NPO-15988**

**Vol. 9, No. 1, P. 64**

Collection of design and testing procedures partly automates development of built-in test chips for CMOS integrated circuits. Testchip methodology intended especially for users of custom integrated-circuit wafers. Test-Chip Designs and Testing Procedures (including data-reduction procedures) generated automatically by computer from programed design and testing rules and from information supplied by user.

## 02 ELECTRONIC SYSTEMS

**B85-10026**

### **HIGH-VISIBILITY DATA DISPLAY**

K. SLUSSER (Rockwell International Corp.)

Jun. 1985

**MFS-19925**

**Vol. 9, No. 1, P. 58**

Data-monitoring system continuously senses output voltages from transducers and provides large, easy-to-read displays of quantities represented by voltages. Measurements of power-supply voltages and currents, pressures, temperatures, strains, and masses displayed. System intended to operate 24 hours a day, producing uninterrupted readouts of critical parameters.

**B85-10027**

### **STORING DATA AND VIDEO ON ONE TAPE**

J. H. NIXON (Southwest Research Institute) and J. P. CATER (Southwest Research Institute)

Jun. 1985

**MSC-20705**

**Vol. 9, No. 1, P. 59**

Microprocessor-based system originally developed for anthropometric research merges digital data with video images for storage on video cassette recorder. Combined signals later retrieved and displayed simultaneously on

**B85-10033**  
**SELF-IDENTIFYING REFLECTING TARGETS**  
 R. E. FRAZER (CALTECH)

Jun. 1985  
 NPO-16106

Vol. 9, No. 1, P. 65

Proposed scheme for target identification requires no radiation of energy by target itself. Instead, target alters light beam reflected from itself back to interrogating station in unique way. Interrogator then identifies target from its signature impressed on returned beam. Self-identifying target useful in surveying, navigation, and remote monitoring (for example, of mountain-climbing parties.)

**B85-10034**  
**FINDING BRIGHT-SPOT COORDINATES IN TELEVISION IMAGES**

T. E. RICHARDSON (Martin Marietta Corp.) and J. C. TIETZ (Martin Marietta Corp.)  
 Jun. 1985

MFS-25999 Vol. 9, No. 1, P. 65

Circuit provides data for computer to calculate coordinates of bright spot of light in video image. Calculation performed while image being scanned, and results available immediately at end of video frame. Video-processing circuit has variety of potential uses in commerce and industry. For example, locates tagged-parts on factory assembly line or track airplane landing lights.

**B85-10035**  
**SYNCHRONIZING DATA-BUS MESSAGES**

L. H. HARRIS (Lockheed Engineering and Management Services Co., Inc.)  
 Jun. 1985

MSC-20640 Vol. 9, No. 1, P. 66

Adapter allows communications among as many as 30 data processors without central bus controller. Adapter improves reliability of multiprocessor system by eliminating point of failure that causes entire system to fail. Scheme prevents data collisions and eliminates nonessential polling, thereby reducing power consumption.

**B85-10036**  
**FIFO BUFFER FOR ASYNCHRONOUS DATA STREAMS**  
 K. P. BASCLE (Harris Corporation)

Jun. 1985  
 MSC-20403

Vol. 9, No. 1, P. 67

Variable-rate, asynchronous data signals from up to four measuring instruments or other sources combined in first-in/first-out (FIFO) buffer for transmission on single channel. Constructed in complementary metal-oxide-semiconductor (CMOS) logic, buffer consumes low power (only 125 mW at 5V) and conforms to aerospace standards of reliability and maintainability.

**B85-10037**  
**SYNCHRONIZATION FOR OPTICAL PPM SIGNALS**  
 V. A. VILNROTTER (CALTECH)

Jun. 1985  
 NPO-16256

Vol. 9, No. 1, P. 68

Method based on statistical properties of weak pulse-position-modulated (PPM) signal enables synchronization of receiver clock with received-signal time base. Method applies to weak optical M-ary PPM signals, for which there is only one pulse of length  $T_p$  transmitted during one of timeslots of length  $T$  in each successive interval of  $M$  timeslots. Method requires small dead time,  $T_d$ , at beginning and end of each timeslot, during which pulse amplitude is zero.

**B85-10038**  
**HIGH-TEMPERATURE HALL-EFFECT APPARATUS**  
 C. WOOD (CALTECH), R. A. LOCKWOOD (CALTECH), A. B. CHEMIELEWSKI (CALTECH), J. B. PARKER (CALTECH), and A. ZOLTAN (CALTECH)

Jun. 1985  
 NPO-16279

Vol. 9, No. 1, P. 70

Compact furnace minimizes thermal gradients and electrical noise. Semiautomatic Hall-effect apparatus takes measurements on refractory semiconductors at temperatures as high as 1,100 degrees C. Intended especially for use with samples of high conductivity and low chargecarrier mobility that exhibit low signal-to-noise ratios, apparatus carefully constructed to avoid spurious electromagnetic and thermoelectric effects that further degrade measurements.

**B85-10039**  
**SINGLE-FREQUENCY MULTITRANSMITTER TELEMETRY**

V. A. CARRENO  
 Jun. 1985  
 LAR-13006

Vol. 9, No. 1, P. 70

Telemetry technique for data collection on general aviation aircraft involved in aeronautical research consists of many sensor/transmitter units at different locations on aircraft. Individual signaling and logic at each sensor/transmitter send signals to single receiver in airplane. Transmitters operate independently on same frequency and are not synchronized to receiver, eliminating erroneous data resulting from two-transmitter overlap.

**B85-10040**  
**DOUBLY-DIFFERENCED MEASUREMENTS FOR ORBIT DETERMINATIONS**

S. C. WU (CALTECH) and V. J. ONDRASKI (CALTECH)  
 Jun. 1985

NPO-16111 Vol. 9, No. 1, P. 71

Report describes accurate method of determining orbit of low-altitude Earth satellite. Method insensitive to clock errors and provides continuous determination of orbit. Report examines effects of employing fewer ground stations, applying different solution strategies, and introducing fictitious thrust parameters to minimize geopotential modeling error - one of major error sources.

**B85-10160**  
**FREQUENCY-DISCRIMINATING ACOUSTIC-EVENT COUNTER**

F. E. SUGG (Rockwell International Corp.) and L. J. GRAHAM (Rockwell International Corp.)  
 Oct. 1985

MSC-20467 Vol. 9, No. 2, P. 56

Broadband events rejected. Acoustic-event counter discriminates against signals that simultaneously exceed preset amplitude thresholds in both low and high-frequency bands of its spectrum. Counter acts as spectral analyzer for mechanical vibrations. In combination with broadband acoustic transducer discriminates between signals and noise in acoustical destructive or nondestructive testing, vibration monitoring for machinery, burglar alarms, and other monitoring/warning systems.

**B85-10161**  
**ONLINE TESTER FOR A SYMBOL GENERATOR**

D. JUDAY (International Business Machines Corp.) and K. MCCONAUGY (International Business Machines Corp.)  
 Oct. 1985

MSC-20357 Vol. 9, No. 2, P. 58

About 95 percent of faults detected. Programmable instrument periodically checks for failures in system that generates alphanumeric and other symbol voltages for cathode-ray-tube displays. Symbol-generator tester compares gated test-point voltages with predetermined voltage limits while circuit under test performs commanded operation. A go/no-go indication given, depending on whether test voltage is or is not within its specification. Tester in plug-in modular form, temporarily wired to generator test points, or permanently wired to these points.

**B85-10162**  
**PROGRAMMABLE DRIVER FOR VOLTAGE-CONTROLLED OSCILLATORS**

## 02 ELECTRONIC SYSTEMS

- L. E. FOWLER (Caltech) and J. A. MCNEIL (Caltech)**  
Oct. 1985  
**NPO-16364** Vol. 9, No. 2, P. 60  
Electronically programmable read-only memory (EPROM) and digital-to-analog converter provide customized time-varying voltage for frequency modulation. Voltage used to modulate IMPATT oscillator that serves as microwave pump for solid-state maser in low-noise amplifier. EPROM simple to tailor voltage waveform to suit characteristics of given maser. Digital information for waveform programmed into EPROM chip; digital-to-analog converter reads information and produces corresponding analog wave. Principle readily adapted to other applications.
- B85-10163**  
**FAST CONTROL SEQUENCER**  
**C. R. LAHMEYER (Caltech)**  
Oct. 1985  
**NPO-16116** Vol. 9, No. 2, P. 60  
Unit faster than conventional circuits and contains fewer integrated circuits. Fast logic controller accommodates three delays before second half cycle of clock signal strobes status latch: Outputs of pipeline register must settle; selected input status line signal must propagate through status multiplexer and arrive at status latch; and it takes 3 nanoseconds for status latch set up before strobed. During second half cycle, output-enable line produces next instruction and applies it to pipeline register.
- B85-10164**  
**PROCESSING OF IMAGE DATA BY INTEGRATED CIRCUITS**  
**R. W. ARMSTRONG (Caltech)**  
Oct. 1985  
**NPO-15059** Vol. 9, No. 2, P. 61  
Sensors combined with logic and memory circuitry. Cross-correlation of two inputs accomplished by transversal filter. Position of image taken to point where image and template data yield maximum value correlation function. Circuit used for controlling robots, medical-image analysis, automatic vehicle guidance, and precise pointing of scientific cameras.
- B85-10165**  
**POINT SIMULATOR FOR SYNTHETIC-APERTURE RADAR**  
**D. PSALTIS (Caltech), M. W. HANEY (Caltech), and K. H. WAGNER (Caltech)**  
Oct. 1985  
**NPO-16296** Vol. 9, No. 2, P. 62  
Reflection from point target imitated electronically. SAR simulator produces amplitude and phase-modulated 60-MHz signal that resembles SAR return of point scatterer. Designed to test integrated optical SAR receivers, simulator applies phase modulation necessary to turn radio-frequency pulse train into electronic equivalent of unfocused radar image of target.
- B85-10166**  
**COMMUNICATIONS HEADGEAR WITH PROTECTIVE FEATURES**  
**S. W. WARD**  
Oct. 1985  
**LAR-13156** Vol. 9, No. 2, P. 63  
Uncomplicated, inexpensive intercom protects head, face, and hearing. Adaptation of highly suitable stock helmet and face shield unit to stock intercom headset provided ideal unit, allowing wearer total use of hands and body while protecting head, face, and hearing. Unit allows wearer to work effectively, efficiently, and safely while communicating from remote areas that require special precautions. Total cost of fabricating unit, using stock parts and including labor, less than \$100.
- B85-10167**  
**AIRBORNE CLOUD DETECTOR**  
**R. E. CAMPBELL and J. P. MCPHERSON**  
Oct. 1985  
**LAR-13137** Vol. 9, No. 2, P. 63  
Bonded to aircraft skin, it facilitates cloud avoidance. Airborne cloud detector consists of three major components: Aluminum patch durably bonded to aircraft skin, surge arrester, and dual-sensitivity charge-rate amplifier. Operation based on fact that aircraft surfaces become charged when ice or water particles strike them. Using increased gain sensitivities, cloudparticle detector reliable, noise-free, low-cost, high-sensitivity indicator of type of clouds that cause most problems for LFC aircraft at cruise altitude.
- B85-10168**  
**RECOVERING MICROWAVE CROSS-POLARIZATION LOSSES**  
**B. L. SEIDEL (Caltech), C. T. STELZRIED (Caltech), and J. E. OHLSON (Caltech)**  
Oct. 1985  
**NPO-15353; NPO-15354; NPO-15803** Vol. 9, No. 2, P. 64  
Reception improved by adding normally discarded portion of signal. For signal enhancement, major and minor signals combined in slaved closed-loop receiver channels. Both receiver channels served by common local oscillator controlled by phase-locked loop in main channel. 10-MHz intermediate-frequency (IF) signals of channels coherently summed. For polarization tracking, phasemeter added to measure phase difference between points A and B. With new circuit, low-level signal used at receiver to augment main signal.
- B85-10169**  
**SATELLITE TIME- AND FREQUENCY-TRANSFER SYSTEM**  
**R. F. C. VESSOT (Smithsonian Institution Astrophysical Observatory), H. PENFIELD (Smithsonian Institution Astrophysical Observatory), and E. MATTISON (Smithsonian Institution Astrophysical Observatory)**  
Oct. 1985  
**MFS-25991** Vol. 9, No. 2, P. 65  
Time synchronized at distant points within nanosecond. Report describes satellite-borne time-and frequency-transfer system proposed for synchronization of clocks at stations around Earth. Orbiting hydrogen-maser clock and frequency standard communicate by microwave links with Earth stations using hydrogen masers as local clocks. Pulsed-laser time-transfer sub-system also operated concurrently, either synchronized or unsynchronized with microwave subsystems.
- B85-10170**  
**LATCHUP IN CMOS INTEGRATED CIRCUITS**  
**K. A. SOLIMAN (Caltech) and D. K. NICHOLS (Caltech)**  
Oct. 1985  
**NPO-16304** Vol. 9, No. 2, P. 66  
Sensitivity to ion beams is studied. Latchup effect subject of paper presenting results of testing 19 types of complementary metal-oxide semiconductor (CMOS) chips from six manufacturers. Report gives details of sensitivity of chips to latchup caused by argon and krypton ion beams. Identifies parasitic npnp paths and provides latchup cross section and qualitative explanation of latchup sensitivity for each chip type.
- B85-10171**  
**INTERFEROMETRY MEASURES ELLIPTICAL SATELLITE ORBITS**  
**R. B. FRAUENHOLZ (Caltech) and J. ELLIS (Caltech)**  
Oct. 1985  
**NPO-16313** Vol. 9, No. 2, P. 66  
Very-long-baseline interferometry offers advantages over conventional Doppler measurements. Conference paper shows feasibility of using data from very-long-baseline interferometry (VLBI) to locate and predict motion of satellites in highly elliptical orbits about Earth. VLBI data obtained from Deep Space Network. Data not only improves

navigation accuracy but also acquired with less use of worldwide network of ground stations.

**B85-10172**  
**PROGRAM PREDICTS NONLINEAR INVERTER PERFORMANCE**

R. R. AL-AYOUBI (Rockwell International Corp.) and T. S. OEPOMO (Rockwell International Corp.)

Oct. 1985

**MSC-20769**

**Vol. 9, No. 2, P. 67**

Program developed for ac power distribution system on Shuttle orbiter predicts total load on inverters and node voltages at each of line replaceable units (LRU's). Mathematical model simulates inverter performance at each change of state in power distribution system.

**B85-10301**  
**WIDE-BRIGHTNESS-RANGE VIDEO CAMERA**

G. D. CRAIG

Jan. 1986

**MFS-25750**

**Vol. 9, No. 3, P. 52**

Television camera selectively attenuates bright areas in scene without affecting dim areas. Camera views scenes containing extremes of light and dark without overexposing light areas and underexposing dark ones. Camera uses liquid-crystal light valve for selective attenuation. Feedback cathode-ray tube locally alters reflection characteristics of liquid-crystal light valve. Results in point-to-point optoelectronic automatic gain control to enable viewing of both dark and very bright areas within scene.

**B85-10302**  
**EXPERIMENTAL PARALLEL-PROCESSING COMPUTER**

J. W. MCGREGOR (Caltech) and M. A. SALAMA (Caltech)

Jan. 1986

**NPO-16043**

**Vol. 9, No. 3, P. 54**

Master processor supervises slave processors, each with its own memory. Computer with parallel processing serves as inexpensive tool for experimentation with parallel mathematical algorithms. Speed enhancement obtained depends on both nature of problem and structure of algorithm used. In parallel-processing architecture, 'bank select' and control signals determine which one, if any, of N slave processor memories accessible to master processor at any given moment. When so selected, slave memory operates as part of master computer memory. When not selected, slave memory operates independently of main memory. Slave processors communicate with each other via input/output bus.

**B85-10303**  
**FAST REED-SOLOMON DECODER**

K. Y. LIU (Caltech)

Jan. 1986

**NPO-15867**

**Vol. 9, No. 3, P. 55**

High-speed decoder intended for use with Reed-Solomon (RS) codes of long code length and high error-correcting capability. Design based on algorithm that includes high-radix Fermat transform procedure, which is most efficient for high speeds. RS code in question has code-word length of 256 symbols, of which 224 are information symbols and 32 are redundant.

**B85-10304**  
**SYSTOLIC VLSI REED-SOLOMON DECODER**

H. M. SHAO (Caltech), T. K. TRUONG (Caltech), L. J. DEUTSCH (Caltech), and J. H. YUEN (Caltech)

Jan. 1986

**NPO-16383**

**Vol. 9, No. 3, P. 56**

Decoder for digital communications provides high-speed, pipelined Reed-Solomon (RS) error-correction decoding of data streams. Principal new feature of proposed decoder is modification of Euclid greatest-common-divisor algorithm to avoid need for time-consuming computations of inverse of certain Galois-field quantities. Decoder architecture suitable for implementation on very-large-scale integrated

(VLSI) chips with negative-channel metaloxide/silicon circuitry.

**B85-10305**  
**ELECTRO-OPTICAL SYSTEM MEASURES AIRCRAFT DEFLECTIONS**

B. FODALE (Grumman Aerospace Corp.), H. R. HAMPTON (Grumman Aerospace Corp.), H. R. SEYMOUR (Grumman Aerospace Corp.), and V. M. DEANGELIS (Dryden Flight Research Facility)

Jan. 1986

**ARC-11454**

**Vol. 9, No. 3, P. 56**

In-flight deflections of aircraft surfaces are measured accurately over wide range of airspeeds and attitudes by electro-optical instrumentation system. Deflections caused by aerodynamic and acceleration forces are measured on wings, stabilizers, helicopter rotors, and other surfaces. Electro-optical system replaces 70-millimeter motor-driven camera previously used to observe deflections.

**B85-10306**  
**MODULAR VLSI REED-SOLOMON DECODER**

K. Y. LIU (Caltech)

Jan. 1986

**NPO-15837**

**Vol. 9, No. 3, P. 58**

Proposed Reed-Solomon (RS) decoder assembled from very-large-scale integrated-circuit (VLSI) building blocks. Decoder exploits recursive forms in RS decoding algorithms. RS codes capable of correcting random or burst errors in telemetry and other data-communication signals. Because of small size and low power consumption, advantageous to employ several such decoders in parallel-processing scheme to increase decoding speed.

**B85-10307**  
**'SPEAKING' MICROCOMPUTER**

C. MANDY (The Boeing Co.) and J. ANNERTON (The Boeing Co.)

Jan. 1986

**MFS-25976**

**Vol. 9, No. 3, P. 62**

Microcomputer system allows blind person to use portable computer and communicate with remote mainframe computer. System prepares data for transmission to mainframe, translates data transmitted from mainframe for its own use, and converts data ordinarily displayed on its video screen into synthesized speech.

**B85-10308**  
**SENSOR TRACKS THE SUN FROM ANY ANGLE**

M. BIRNBAUM, M. (Caltech) and R. L. BUNKER (Caltech)

Jan. 1986

**NPO-16211**

**Vol. 9, No. 3, P. 62**

Sensor system locates Sun from any angle and generates error signals to point object toward Sun and follow its motion. Sun-sensor system includes three photodetectors, each with separate field of view defined by set of apertures. As equipment rotates about axis, detectors put out time-varying signals processed by external electronics to determine rotation rate and direction to Sun.

**B85-10309**  
**INTERFACE CIRCUITS FOR SELF-CHECKING MICRO-PROCESSORS**

D. A. RENNELS (Caltech) and R. CHANDRAMOULI (Caltech)

Jan. 1986

**NPO-15700**

**Vol. 9, No. 3, P. 63**

Fault-tolerant-microcomputer concept based on enhancing 'simple' computer with redundancy and self-checking logic circuits detect hardware faults. Interface and checking logic and redundant processors confer on 16-bit microcomputer ability to check itself for hardware faults. Checking circuitry also checks itself. Concept of self-checking complementary pairs (SCCP's) employed throughout ICL unit.

## 02 ELECTRONIC SYSTEMS

- B85-10310**  
**CONTROLLERS FOR FLOW-FIELD SURVEY APPARATUS**  
J. ASHBY, GEORGE C. and M. D. VACCARELLI  
Jan. 1986  
**LAR-13180** Vol. 9, No. 3, P. 64  
Control systems of flow-field survey apparatuses of 22-inch (56centimeter) Hypersonic Helium Facility (two-dimensional) and 20-inch (51centimeter) Mach 6 Tunnel (three-dimensional) at Langley Research Center equipped with single-chip microcomputer and single-board microcomputer, respectively, to drive probes at selected speeds and perform other functions automatically. Various modes of operation programmed as need arises. Both of these control systems fabricated relatively inexpensively from commercially available stock components.
- B85-10311**  
**FAST VLSI VITERBI DECODER**  
C. C. WANG (Caltech)  
Jan. 1986  
**NPO-16365** Vol. 9, No. 3, P. 65  
Fast Viterbi decoder with fully parallel, pipeline architecture implemented on two VLSI NMOS chips. Decoder used with constraint-length-7, rate-1/2, convolutional error-correcting code widely used by NASA for deepspace telemetry data. With this (7,1/2) code, bit stream contains 2 bits per original data bit, and information about 1 data bit distributed over 7 pairs of bits. Design principles of decoder also applicable to Viterbi codes of other lengths and rates.
- B85-10312**  
**IMAGE INTERPOLATION WITH DEDICATED DIGITAL HARDWARE**  
R. HARTENSTEIN, G. WAGNER (TCG, Inc.), D. SIMONS (Ideas, Inc.), and J. COULSON (Ideas, Inc.)  
Jan. 1986  
**GSC-12882** Vol. 9, No. 3, P. 66  
Algorithm for interpolating two-dimensional image data to change picture-element spacing implemented in dedicated digital hardware for high-speed execution. System interpolates 100 times as fast as generalpurpose computer. Image resampling occurs first along one image axis and then along other, using two interpolation devices implemented in series.
- B85-10313**  
**LASER LINKS FOR INSTRUMENTATION SYSTEMS**  
P. S. BAILEY (McDonnell Douglas Corp.)  
Jan. 1986  
**MSC-20863** Vol. 9, No. 3, P. 67  
Laser Links eliminate costly cables connecting sensors to data-collection centers. Data-transmission scheme uses laser-based communication systems instead of cables. Sensor data transmitted by semiconductor-diode lasers effective over line-of-sight distances of up to several hundred meters. Use of lasers instead of cables simplifies number of installations.
- B85-10314**  
**COST AND PERFORMANCE MODEL FOR PHOTOVOLTAIC SYSTEMS**  
C. S. BORDEN (Caltech), J. H. SMITH (Caltech), M. C. DAVISSON (Caltech), and L. J. REITER (Caltech)  
Jan. 1986  
**NPO-16404** Vol. 9, No. 3, P. 67  
Lifetime cost and performance (LCP) model assists in assessment of design options for photovoltaic systems. LCP is simulation of performance, cost, and revenue streams associated with photovoltaic power systems connected to electric-utility grid. LCP provides user with substantial flexibility in specifying technical and economic environment of application.
- B85-10315**  
**COMPUTER-AIDED RELIABILITY ESTIMATION**  
S. J. BAVUSO, J. J. STIFFLER (Sequoia Systems, Inc.), L. A. BRYANT (Sequoia Systems, Inc.), and P. L. PETERSEN (Kentrion International, Inc.)  
Jan. 1986  
**LAR-13349** Vol. 9, No. 3, P. 68  
CARE III (Computer-Aided Reliability Estimation, Third Generation) helps estimate reliability of complex, redundant, fault-tolerant systems. Program specifically designed for evaluation of fault-tolerant avionics systems. However, CARE III general enough for use in evaluation of other systems as well.
- B85-10447**  
**VIBRATION-FREE RAMAN DOPPLER VELOCIMETER**  
R. J. EXTON  
Mar. 1986 See Also (N84-25433)  
**LAR-13268** Vol. 9, No. 4, P. 62  
New method under development to measure flow velocity of molecules directly by nonintrusive laser techniques. This method, combined with vibration-free design, makes flow-velocity measurements practical in severe vibrational environments. Raman scattering and retroreflection combine to yield useful technique for wind-tunnel gas-flow mapping. Nonintrusive measurements of gas velocity, temperature, and pressure possible in highly vibrational environment.
- B85-10448**  
**MODULAR, FAST, TWO-DIMENSIONAL CYCLIC CONVOLVER**  
K. Y. LIU (Caltech)  
Mar. 1986  
**NPO-16379** Vol. 9, No. 4, P. 63  
Proposed high-throughput, real-time synthetic-aperture-radar (SAR) processor built using new, modular, two-dimensional cyclic convolver architecture based on polynomial factorization and designed for very-large-scale integrated (VLSI) circuitry. New architecture reduces cost, size, and power dissipation of SAR processor in comparison to high-speed array-processor approach. Processor also used for other image-and data-processing applications involving two-dimensional Fourier transforms.
- B85-10449**  
**ROTATING CAPACITOR MEASURES STEADY ELECTRIC FIELDS**  
A. R. JOHNSTON (Caltech), H. KIRKHAM (Caltech), and B. ENG (Caltech)  
Mar. 1986  
**NPO-16550** Vol. 9, No. 4, P. 64  
Portable sensor measures electric fields created by dc powerlines or other dc-high-voltage sources. Measures fields from 70 to 50,000 V/m with linearity of 2 percent. Sensor used at any height above ground. Measures both magnitude and direction of field and provides signals representing these measurements to remote readout device. Sensor functions with minimal disturbance of field it is measuring.
- B85-10450**  
**GENERATING TUNABLE FAR-INFRARED LASER SIDEBANDS**  
H. M. PICKETT (Caltech) and J. FARHOOMAND (Caltech)  
Mar. 1986  
**NPO-16497** Vol. 9, No. 4, P. 65  
New tunable source extends infrared spectroscopy into far infrared wavelengths. Frequency-Tunable far-infrared radiation produced by mixing of fixed-frequency far-infrared laser beam with output of frequency-tunable klystron. By sweeping klystron frequency in synchronism with video display of detector output, one obtains direct presentation of absorption-cell spectrum. Immediate applications are local oscillator for heterodyne systems and tunable source for spectroscopy.
- B85-10451**  
**CONVOLVER FOR PIPELINED-IMAGE PROCESSOR**

B. WILCOX (Caltech)

Mar. 1986  
NPO-16462

Vol. 9, No. 4, P. 66

3 x 3 convolver produces weighted sum of nine contiguous picture elements in square. Data processed through convolver at video scanning rate of current raster line. Two previous lines stored in external buffers (N-3) element delays. Specific choice of convolution weights determines whether convolver performs smoothing, spatial-frequency filtering, edge detection, or other forms of image processing.

B85-10452

**SINGLE-CHIP VLSI REED-SOLOMON ENCODER**

T. K. TRUONG (Caltech), L. J. DEUTSCH (University of Southern California), and I. S. REED (University of Southern California)

Mar. 1986  
NPO-16122

Vol. 9, No. 4, P. 67

Reed-Solomon (RS) encoder based on Berlekamp bit-serial multiplier algorithm. RS code standard, based on code words of 255 8-bit symbols, of which 223 symbols convey information and remaining 32 are check symbols. This code enables correction of up to 16 erroneous information symbols per word. Berlekamp algorithm based on code-generating polynomial with 32 roots that occur in reciprocal pairs. Choice of algorithm permits compact design.

B85-10453

**AUTOMATIC GUIDANCE FOR REMOTE MANIPULATOR**

A. R. JOHNSTON (Caltech)

Mar. 1986  
NPO-13386

Vol. 9, No. 4, P. 68

Position sensor and mirror guides manipulator toward object. Grasping becomes automatic when sensor begins to receive signal from reflector on object to be manipulated. Light-emitting diodes on manipulator produce light signals for reflector, which is composite of plane and corner reflectors. Proposed scheme especially useful when manipulator arm tends to flex or when object is moving. Sensor and microprocessor designed to compensate for manipulator arm oscillation.

B85-10454

**TESTING ELECTRONIC DEVICES FOR SINGLE-EVENT UPSET**

D. K. NICHOLS (Caltech), W. E. PRICE (Caltech), and C. J. MALONE (Caltech)

Mar. 1986  
NPO-16468

Vol. 9, No. 4, P. 69

Report prepared describes equipment and summarizes both pretest and onsite procedures for testing of digital electronic devices for susceptibility to single-event upset. Term 'single-event upset' denotes variety of temporary or permanent bit flips or latchup induced by single particles of ionizing radiation. Vacuum chamber houses device under test while exposed to ion beam. Vacuum chamber and associated equipment must be brought to ion-beam facility for test.

B85-10455

**MEASURING ANTENNA SIGNAL DELAYS**

T. Y. OTOSHI (Caltech) and A. R. HOWLAND (Caltech)

Mar. 1986  
NPO-15947

Vol. 9, No. 4, P. 70

Signal delays in large dish antennas measured by method based on commercial frequency-modulated instrument. Measurements accurate within 3 ns on primary path lengths of 60 ns or more. Major benefit of method is user distinguishes between delay along the primary signal path and delays along multiple-reflection signal paths (multipaths), so multipath errors minimized or made insignificant in calibration of antenna delays.

B85-10456

**MULTIPLIER ARCHITECTURE FOR CODING CIRCUITS**

C. C. WANG (Caltech), T. K. TRUONG (Caltech), H. M.

SHAO (Caltech), and L. J. DEUTSCH (Caltech)

Mar. 1986  
NPO-16363

Vol. 9, No. 4, P. 74

Multipliers based on new algorithm for Galois-field (GF) arithmetic regular and expandable. Pipeline structures used for computing both multiplications and inverses. Designs suitable for implementation in very-large-scale integrated (VLSI) circuits. This general type of inverter and multiplier architecture especially useful in performing finite-field arithmetic of Reed-Solomon error-correcting codes and of some cryptographic algorithms.

B85-10457

**IMPROVED ELECTRONIC CONTROL FOR ELECTROSTATIC PRECIPITATORS**

D. F. JOHNSTON

Mar. 1986  
LAR-13273

Vol. 9, No. 4, P. 78

Electrostatic precipitators remove particulate matter from smoke created by burning refuse. Smoke exposed to electrostatic field, and particles become electrically charged and migrate to electrically charged collecting surfaces. New microprocessor-based electronic control maintains precipitator power at maximum particulate-collection level. Control automatically senses changes in smoke composition due to variations in fuel or combustion and adjusts precipitator voltage and current accordingly. Also, sensitive yet stable fault detection provided.

B85-10458

**PICTURE-ELEMENT COMPARATOR**

D. B. GENNERY (Caltech)

Mar. 1986  
NPO-16464

Vol. 9, No. 4, P. 77

Proposed circuit, called 'neighborhood comparison operator,' compares data from neighboring picture elements (pixels) to find peaks, ridges, and valleys in picture data. Circuit also able to expand or shrink pixel regions. Circuit concept developed for image-processing computers. Circuit handles data stream of 12-bit pixels rather than conventional 8 or 16 bits. Consist entirely of standard logic chips.

B85-10459

**PROGRAMMABLE PIPELINED-IMAGE PROCESSOR**

D. B. GENNERY (Caltech) and B. WILCOX (Caltech)

Mar. 1986  
NPO-16463

Vol. 9, No. 4, P. 77

Computer serves as pipelined processor for imagery or other two-dimensional digital data. Processor does feature extraction, smoothing, edge detection, texture measurement, and stereoscopic area correlation. Also plans routes for obstacle avoidance by robots and solves two-dimensional partial differential equations. Image processor consists of modular units: each includes set of computing elements of types particularly useful in pipelined-image processing. Flexible interconnection scheme used to route data to subsequent stages of pipeline.

B85-10460

**FUNCTION GENERATOR FOR IMAGE PROCESSOR**

D. B. GENNERY (Caltech) and B. WILCOX (Caltech)

Mar. 1986  
NPO-16461

Vol. 9, No. 4, P. 78

Basic elements of function generator are memory chips and interpolator chip, which incorporates multipliers and adders. Memory includes CMOS static random-access devices. 120 ns cycle time of devices allows real-time processing of image data.

B85-10461

**DESIGN OF LINEAR QUADRATIC REGULATORS AND KALMAN FILTERS**

B. LEHTINEN and L. GEYSER

Mar. 1986  
LEW-14126

Vol. 9, No. 4, P. 79

AESOP solves problems associated with design of

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controls and state estimators for linear time-invariant systems. Systems considered are modeled in state-variable form by set of linear differential and algebraic equations with constant coefficients. Two key problems solved by AESOP are linear quadratic regulator (LQR) design problem and steady-state Kalman filter design problem. AESOP is interactive. User solves design problems and analyzes solutions in single interactive session. Both numerical and graphical information available to user during the session.

## 03 PHYSICAL SCIENCES

### B85-10041 PROTECTIVE PACKAGE FOR A GAMMA-RAY DETECTOR

M. FONG (CALTECH), C. LUCAS (CALTECH), A. METZGER (CALTECH), D. M. MOORE (CALTECH), R. OLIVER (CALTECH), and W. PETRICK (CALTECH)

Jun. 1985

NPO-16019

Vol. 9, No. 1, P. 72

Package for germanium gamma-ray detector protects semiconductor crystal from contamination, allows it to operate at high voltages, and isolates from shock and vibration. Package seals detector from its surroundings, whether in atmosphere or in vacuum of space. Main parts of package made of aluminum. Cover sealed to base by soft aluminum ring.

### B85-10042 VARIABLE-TEMPERATURE-GRADIENT DEVICE FOR SOLIDIFICATION RESEARCH

W. F. KAUKLER (Kaukler, William F.)

Jun. 1985

MFS-26008

Vol. 9, No. 1, P. 73

Device for research in solidification and crystal growth allows crystallization of melt observed as occurs. Temperature gradient across melt specimen increased or decreased rapidly while solidification front proceeds at constant speed across sample. Device moves sample at same speed, thereby holding position of liquid/solid interface stationary within field of optical microscope. Device, variable-temperature-gradient microscope stage, used to study crystal growth at constant rate while thermal driving force is varied.

### B85-10043 TELESCOPE WITH REFLECTING BAFFLE

W. I. LINLOR

Jun. 1985 NASA TM-84406 (N84-13985/NSP)

ARC-11502

Vol. 9, No. 1, P. 74

Telescope baffle made from combination of reflecting surfaces. In contrast with previous ellipsoidal reflecting baffles, new baffle reflects skew rays more effectively and easier to construct. For infrared telescopes, reflecting baffles better than absorbing baffles because heat load reduced, and not necessary to contend with insufficiency of infrared absorption exhibited by black coatings.

### B85-10044 OUT-OF-FOCUS ALINEMENT OF SOLAR CONCENTRATORS

M. J. ARGOUD (CALTECH) and E. W. DENNISON (CALTECH)

Jun. 1985

NPO-15563

Vol. 9, No. 1, P. 75

In new alignment technique, no attempt made to simulate infinitely distant light source, and all mirrors left uncovered throughout procedure. Light source placed at

distance of 1,650 feet (503 m); other distances used. Alinement of approximately 250 mirror facets of paraboloidal solar concentrator simplified by precalculated images reflected from all facets. Developed for large solar concentrators, technique used with other multiple-mirror or multiple-light-source systems for producing specified illuminance patterns.

### B85-10045 MEASURING CLOUDS WITH MICROWAVES AND INFRARED

P. C. PANDEY (CALTECH), E. G. NJOKU (CALTECH), and J. W. WATERS (CALTECH)

Jun. 1985

NPO-16265

Vol. 9, No. 1, P. 75

Combination of microwave and infrared measurements from satellites yields data from which thicknesses and temperature of clouds inferred. Microwave radiation measured by satellite used to determine thickness of cloud and difference between cloud-top temperature and mean temperature of interior. Technique extends capability of previously established method in which infrared radiation returned to satellite by cloud used to determine temperature and altitude of cloud top and fractional area of Earth covered by cloud.

### B85-10046 IMAGING SPECTROMETER FOR GEOPHYSICAL SURVEYS

C. C. LABAW (CALTECH)

Jun. 1985

NPO-16072

Vol. 9, No. 1, P. 76

Airborne spectrometer combines technologies of television imaging and spectroscopy to produce data for geophysical surveys, agricultural assessments, forest and land management, and exploration for oil and minerals. Designed for Small Size, infrared imaging spectrometer uses folded telescope and passes input and output of its monochromator through hole in monochromator grating. Instrument permits analysis of terrain at many infrared wavelengths.

### B85-10047 NEARLY ANASTIGMATIC X-RAY TELESCOPE

D. KORSCH (Korsch Optics, Inc.)

Jun. 1985

MFS-25984

Vol. 9, No. 1, P. 77

Proposed X-ray telescope made of many concentric reflecting rings, each of which consists of two portions of cone. Proposed design is variation on conventional grazing incidence X-ray telescope, which has just one twosegment reflecting element but suffers from excessive astigmatism and field curvature. Using many short elements instead of single long element, new design gives nearly anastigmatic image.

### B85-10048 THERMALLY-RECHARGEABLE ELECTROCHEMICAL CELL

R. RICHTER (CALTECH)

Jun. 1985

NPO-16273

Vol. 9, No. 1, P. 78

Proposed liquid-sodium/sulfur electrochemical cell recharged by heat, rather than electric generator. Concept suitable for energy storage for utilities, mobile electronic equipment, and solar thermoelectric power systems. Sodium ions driven across membrane with aid of temperature differential.

### B85-10049 SPECTROPHOTOVOLTAIC POWER GENERATION

G. KNOWLES (Honeywell, Inc.) and J. CARROLL (Honeywell, Inc.)

Jun. 1985

MFS-27027

Vol. 9, No. 1, P. 78

Optical Components of spectrophotovoltaic system concentrate light from Sun and redirect short-wavelength

portion of spectrum to solar cell having large gap in energy band (gallium arsenide cell). Longer-wavelength portion of spectrum passes through beam splitter to cell with smaller gap in energy band (silicon band). Available energy in Sunlight thus exploited more fully and, improvements in energy-conversion efficiency possible.

**B85-10050**  
**METHANOL FUEL CELL**  
G. E. VOECKS (CALTECH)  
Jun. 1985  
NPO-15823

Vol. 9, No. 1, P. 79

In proposed fuel-cell system, methanol converted to hydrogen in two places. External fuel processor converts only part of methanol. Remaining methanol converted in fuel cell itself, in reaction at anode. As result, size of fuel processor reduced, system efficiency increased, and cost lowered.

**B85-10051**  
**MANIPULATOR FOR HEATING AND COOLING IN ULTRAHIGH VACUUM**  
R. OUTLAW and B. T. BAUGH  
Jun. 1985  
LAR-13040

Vol. 9, No. 1, P. 80

In sample-transfer system for use in ultrahigh vacuum, samples mounted on threaded circular holder transferred to flip mechanism of manipulator by simple translation and rotation. Flip mechanism contains electrode assembly and thermocouple that make direct contact with sample. Copper plate and flexible strap attached to receiving block to cool sample. Simple modifications allow broad range of sample temperatures (150 to 1,750 K) and direct temperature measurements, while retaining advantage of additional degree of freedom provided by flip mechanism of precise manipulator.

**B85-10052**  
**WIDE-ANGLE, WIDE-BAND CAMERA FOR REMOTE IMAGING**  
P. D. ATCHESON (University of Arizona)  
Jun. 1985  
NPO-15799

Vol. 9, No. 1, P. 81

Improved ultraviolet-to-infrared camera design combines high resolution and relatively wide field of view in remote-imaging system. Although design intended for satellite-borne system to give information on such Earth features as vegetation, pollution, and land formation mineral deposits, optical principle also useful in ground-based or airborne high-resolution television for imaging objects at great distances.

**B85-10053**  
**SEGMENTED DETECTOR FOR COSMIC GAMMA RAYS**  
L. S. VARNELL (CALTECH)  
Jun. 1985  
NPO-16245

Vol. 9, No. 1, P. 82

Segmented structure distinguishes gamma rays of cosmic origin from internal radioactivity. Preamplifier and discriminator channel connects each electrically independent segment of gamma-ray detector to logic circuitry. Logic compares and analyzes events in segments to determine sources. According to Monte Carlo calculations, sensitivity of detector two to three times better than conventional detectors because background interactions discerned and eliminated.

**B85-10054**  
**ALTERING FLASHLAMP OUTPUT FOR REALISTIC SOLAR SIMULATION**  
R. L. MUELLER (CALTECH) and C. H. SEAMAN (CALTECH)  
Jun. 1985  
NPO-16167

Vol. 9, No. 1, P. 82

Commercial glass optical filter corrects spectrum of xenon flashtubes used to test photovoltaic solar cells. Filter withstands thousands of flashes without perceptible altera-

tion of passband characteristics. With filter, calibration errors reduced to less than 1 percent.

**B85-10055**  
**ESTIMATES OF LATENT HEAT IN CLOUDS**  
P. J. SMITH (Purdue Research Foundation)  
Jun. 1985  
MFS-25977

Vol. 9, No. 1, P. 85

Release of latent heat in formation of clouds and precipitation estimated more accurately with simple technique that merges satellite cloud imagery with rawinsonde (tracked-radiosonde) data on air pressure, temperature, humidity, windspeed, and wind direction. Technique created to improve diagnosis of energy states and transformations in extratropical cyclones.

**B85-10056**  
**LASER-ASSISTED ANALYSIS OF AEROSOL PARTICLES**  
M. P. SINHA (CALTECH), C. E. GIFFIN (CALTECH), D. D. NORRIS (CALTECH), and S. K. FRIEDLANDER (CALTECH)  
Jun. 1985  
NPO-15308

Vol. 9, No. 1, P. 86

Proposed instrument makes rapid mass-spectrometric analyses of individual particles in aerosols. Each particle vaporized and ionized by intense laser pulse, which creates ions of minimum complexity. Ability to analyze single aerosol particles continuously makes technique suitable for detection of toxic aerosol particles on real-time basis and for identification of their sources.

**B85-10057**  
**ULTRAHIGH-VACUUM SAMPLE-TRANSFER SYSTEM**  
R. OUTLAW and B. T. BAUGH  
Jun. 1985  
LAR-12993

Vol. 9, No. 1, P. 86

Ultrahigh-vacuum (UHV) sample-transfer system developed features short-term (less than 30 minutes) transfer of samples from atmospheric pressure into sample manipulator within UHV analysis system without significantly degrading system pressure. New system is austere approach to sample transfer, involving no automation. Total cost of system is factor of 10 less than commercially available instruments.

**B85-10058**  
**BATTERY-CHARGE-STATE MODEL**  
H. C. VIVIAN (CALTECH)  
Jun. 1985  
NPO-16158

Vol. 9, No. 1, P. 87

Charge-state model for lead/acid batteries proposed as part of effort to make equivalent of fuel gage for battery-powered vehicles. Models based on equations that approximate observable characteristics of battery electrochemistry. Uses linear equations, easier to simulate on computer, and gives smooth transitions between charge, discharge, and recuperation.

**B85-10059**  
**ENVIRONMENTAL DEGRADATION OF SOLAR REFLECTORS**  
F. L. BOUQUET (CALTECH)  
Jun. 1985  
NPO-16053

Vol. 9, No. 1, P. 88

Report presents results of study of atmospheric degradation of large solar reflectors for power generators. Three general types of reflective surfaces investigated. Report also describes computer buildup and removal (by rain and dew) of contamination from reflectors. Data used to determine effects of soil buildup and best method and frequency of washing at various geographic locations.

**B85-10173**  
**SEGMENTED TROUGH REFLECTOR**  
W. R. SZMYD (Lockheed Missiles & Space Co., Inc.)  
Oct. 1985  
NPO-15026

Vol. 9, No. 2, P. 68

Segmented troughlike reflector for solar cells approach

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concentration effectiveness of true parabolic reflector yet simpler and less expensive. Walls of segmented reflector composed of reflective aluminized membrane. Lengthwise guide wire applies tension to each wall, thereby dividing each into two separate planes. Planes tend to focus Sunlight on solar cells at center of trough between walls. Segmented walls provide higher Sunlight concentration ratios than do simple walls.

**B85-10174**  
**WINDOWLESS HIGH-PRESSURE SOLAR REACTOR**  
K. N. R. RAMOHALLI (Caltech)

Oct. 1985  
**NPO-16310**

**Vol. 9, No. 2, P. 68**

Obscuration by reaction products eliminated. Chemical reactor heated by Sunlight employs rocket technology to maintain internal pressure. Instead of keeping chamber tightly closed, pressure maintained by momentum balance between incoming and outgoing materials. Windowless solar reactor admits concentrated Sunlight through exhaust aperture. Pressure in reactor maintained dynamically.

**B85-10175**  
**MONITORING TRACE GASES IN THE ATMOSPHERE**  
C. R. WEBSTER (Caltech) and W. B. GRANT (Caltech)

Oct. 1985

**NPO-16278**

**Vol. 9, No. 2, P. 69**

Tunable laser spectrometer uses reflections from ordinary objects. Topographic target (ordinary feature of surroundings) returns enough energy to receiver so absorption by trace gases detected. Chopping laser beam allows return to be compared with original signal. Amplifier locks in on chopping frequency or laser modulation frequency. In laboratory simulations, spectrometer detected nitrogen dioxide in concentrations of only few parts per million.

**B85-10176**  
**MEASURING SOIL HYDRAULIC CONDUCTIVITY WITH MICROWAVES**

B. J. BLANCHARD and P. E. ONEILL

Oct. 1985

**GSC-12937**

**Vol. 9, No. 2, P. 70**

Soil mapping for large or small areas done rapidly. Technique requires simple radiometric measurements of L-band (15 to 30 cm) and thermal infrared emissions from ground within 2 days after saturation of surface. Technique based on observation that correlation exists between L-band emissivity and hydraulic conductivity of soil.

**B85-10177**  
**HIGH-PERFORMANCE HEAT PIPE**

J. P. ALARIO (Grumman Aerospace Corp.), R. KOSSON (Grumman Aerospace Corp.), and R. HASLETT (Grumman Aerospace Corp.)

Oct. 1985

**MSC-20136**

**Vol. 9, No. 2, P. 70**

Single vapor channel and single liquid channel joined by axial slot. New design, permits high heat-transport capacity without excessively reducing heat-transfer efficiency. Contains two large axial channels, one for vapor and one for liquid, permitting axial transport and radial heat-transfer requirements met independently. Heat pipe has capacity of approximately 10 to sixth power watt-inches (2.5 X 10 to sixth power watt-cm) orders of magnitude greater than heat capacity of existing heat pipes. Design has high radial-heat-transfer efficiency, structurally simple, and has large liquid and vapor areas.

**B85-10178**  
**AIRBORNE DIAL SYSTEM FOR REMOTE TROPOSPHERIC SENSING**

E. V. BROWELL

Oct. 1985

**LAR-13002**

**Vol. 9, No. 2, P. 71**

Spatial distribution of gases and of aerosols measured. Airborne DIAL system uses two frequency-doubled Nd:YAG

lasers and mounted in NASA Wallops Electra aircraft. Multipurpose airborne differential absorption lidar (DIAL) system, developed at Langley Research Center, remotely measures profiles of various gases and aerosols in diverse atmospheric investigations. Capability to rapidly determine spatial distribution of gases such as ozone, water vapor, sulfur dioxide, and nitrogen dioxide and to measure simultaneously distribution of aerosols at several laser wavelengths provides opportunity for developing extensive data base for examining complex interaction of atmospheric dynamics and chemistry.

**B85-10179**  
**ANALYZING MICROCHIPS WITH DARK-FIELD NEGATIVE PHOTOMICROGRAPHY**

S. F. SUSZKO (Caltech)

Oct. 1985

**NPO-16299**

**Vol. 9, No. 2, P. 72**

Inverse development process yields fine details. Photomicrographic technique produces images of integrated-circuit chips. Technique based on dark-field illumination: (chip lit with bright central spot of light and photographed by light scattered or diffracted from spot. Reveals more about microstructure patterns related to photoresist masking than more conventional bright-field method.

**B85-10180**  
**OPTICAL MOUNTS FOR CRYOGENIC BEAM SPLITTERS**

A. A. RUDMAN

Oct. 1985

**GSC-12923**

**Vol. 9, No. 2, P. 73**

Spring-loaded optical mounts maintain flatness and alignment of rigid, framed, or pellicle beam splitters over wide temperature range, despite differences in thermal expansion among materials. Mounts permit optical adjustments at ambient temperature even though optical system operated subsequently within few degrees of absolute zero. Mounts useful as holders for integrated-circuit master patterns, survey targets, vibrating membranes, noise- or pressure-sensing membranes, osmosis filters, and fuel-cell elements.

**B85-10181**  
**ESTIMATING ANTENNA SHAPE FROM FAR-FIELD MEASUREMENTS**

Y. RAHMAT-SAMII (Caltech)

Oct. 1985

**NPO-16425**

**Vol. 9, No. 2, P. 74**

Amplitude and phase measurements help characterize nearly paraboloidal reflectors. Deviation of microwave reflector from ideal paraboloidal shape deduced from far-field amplitude and phase measurements with help of theoretical technique referred to as microwave holographic metrology. Technique enables estimation of antenna-surface figure from measurements taken at prescribed number of field points. After determining amount of surface deviation, performance of antenna then improved by properly adjusting surface panels.

**B85-10182**  
**IMPROVED THERMAL-DIFFUSIVITY-MEASURING APPARATUS**

C. WOOD (Caltech) and A. ZOLTAN (Caltech)

Oct. 1985

**NPO-16280**

**Vol. 9, No. 2, P. 76**

Accuracy at high temperature improved. Furnace heats specimen to experimental temperature, and flash tube raises specimen temperature by small amount and for short time so diffusivity (composite property of heat capacity and conductivity) determined. Specimen mount ensures minimum heat loss during temperature-rise measurement. Measurement temperatures up to 1,000 degrees C realized with fused-quartz light pipe and up to 1,600 degrees C with sapphire light pipe.

**B85-10183  
MEASURING MOISTURE IN SEALED ELECTRONIC ENCLOSURES**

J. KRIEG, HERMANC. (TRW, Inc.)

Oct. 1985

MSC-18886

Vol. 9, No. 2, P. 78

Instrument checks trace amounts accurately. Moisture in hermetically-sealed electronic equipment measured by instrument designed for field use. Instrument also measures pressure, volume, and contaminants of gas in sealed enclosure. Plumbing for instrument uses vacuum-tight valves so any portion of instrument cleansed by opening certain valves to vacuum source. To ensure accuracy, manifolds are of minimal volume, each comprising only volume within cross-shaped tubing fittings.

**B85-10184  
LENS-AND-DETECTOR ARRAY FOR SPECTROMETER**

J. OBERHEUSER (Perkin-Elmer Corp.)

Oct. 1985

NPO-16388

Vol. 9, No. 2, P. 80

Supporting structure aligns lenses and serves as light baffle. Lenses and infrared detectors mounted together in cavities in electroformed plate. Plate and cavities maintain optical alignment while serving as light baffle and aperture stop.

**B85-10185  
ESTIMATING THE PERFORMANCE OF A CONCENTRATING SOLAR ARRAY**

E. P. FRENCH (Rockwell International Corp.), M. W. MILLS (Rockwell International Corp.), and Z. BACKOVSKI (Rockwell International Corp.)

Oct. 1985

MFS-28021

Vol. 9, No. 2, P. 82

Comprehensive mathematical-analysis technique developed for array of solar-photovoltaic panels equipped with truncated-pyramid concentrators. Hollow pyramidal concentrator reflects sunlight onto panel of photovoltaic cells. Comprehensive optical, thermal, and electrical analysis performed on array of units. Technique applicable, with modifications, to analysis and design of other multiple-cell reflecting photovoltaic systems.

**B85-10186  
CROSSOVER CONCEPT FOR OPTICAL PRINTED CIRCUITS**

R. S. JAMIESON (Caltech)

Oct. 1985

NPO-15131

Vol. 9, No. 2, P. 82

It is possible to reduce crosstalk between optical signals in intersecting optical conductors by taking two steps: Minimize amount of light diffracted into wrong conductor by selecting optimum conductor width, and place light traps in each conductor. How well techniques work depends in part on quality of optical conductors (partially surface smoothness) and on how closely optical-signal mode of propagation approaches ideal. Nature of signals also important: With digital signals, less crosstalk attenuation required than for analog signals.

**B85-10187  
MULTIBAND SELECTOR FOR LINEAR PHOTODETECTOR ARRAY**

H. L. RICHARD

Oct. 1985

GSC-12911

Vol. 9, No. 2, P. 83

Line image observed simultaneously in two or more spectral bands. Incoming light focused through beam splitter onto two linear arrays of photodetectors to form line images. Array of band-pass filters above each detector array positioned to select spectral band of line image. These capabilities are valuable in such multispectral-imaging applications as spaceborne and airborne visible and infrared observation of Earth for geology, oil and mineral exploration,

biomass distribution, forestry, agriculture, and urban and rural development.

**B85-10188  
INTEGRATING RESIDENTIAL PHOTOVOLTAICS WITH POWER LINES**

C. S. BORDEN (Caltech)

Oct. 1985 See Also N84-16643

NPO-16331

Vol. 9, No. 2, P. 84

Report finds rooftop solar-cell arrays feed excess power to electric-utility grid for fee are potentially attractive large-scale application of photovoltaic technology. Presents assessment of breakeven costs of these arrays under variety of technological and economic assumptions.

**B85-10189  
TESTS OF LOW-CONCENTRATION-RATIO PHOTOVOLTAIC ELEMENTS**

M. W. MILLS (Rockwell International Corp.) and Z. F. BACKOVSKI (Rockwell International Corp.)

Oct. 1985

MFS-28020

Vol. 9, No. 2, P. 84

Report describes performance measurements on elements of low-concentration-ratio solar arrays (LCRSA's) employing silicon and gallium arsenide photovoltaic cells. Measurements intended to verify predictions of performance based on mathematical models. Measured and predicted values found to agree closely for both normal and off-normal pointing of array toward Sun.

**B85-10190  
AUGMENTING THRUST WITH WASTE HEAT**

R. H. FRISBEE (Caltech)

Oct. 1985

NPO-16218

Vol. 9, No. 2, P. 86

According to NASA report, energy rejected by nuclear reactor adds to rocket thrust. With augmentation, specific impulse increased by as much as 23 percent over that of conventional engine.

**B85-10191  
DUCT-FLOW ANALYSIS**

T. KATSANIS

Oct. 1985

LEW-14000

Vol. 9, No. 2, P. 86

Quasi-two-dimensional velocity distribution through annular duct calculated. Computer program ANDUCT developed for calculating velocity distribution along arbitrary line between inner and outer walls of annular duct with axisymmetric swirling flow. Velocity gradient equation used with assumed variation of meridional streamline curvature. ANDUCT written in FORTRAN IV for use on IBM 370/3033 computer.

**B85-10316  
MOLECULAR-BEAM CHOPPER AND FOUR-CHANNEL AMPLIFIER**

B. R. ADAMS (Kentron International, Inc.)

Jan. 1986

LAR-13174; LAR-13175

Vol. 9, No. 3, P. 72

Molecular-beam chopper phase controller and timing interface is subsystem of four-stage, differentially pumped, modulated molecular-beam/mass spectrometer. Subsystem maintains accurate phase control and timing for repetitive signal averaging over several hours of operation. Chopper phase controller/ timing interface and four-channel programmable time-multiplexed amplifier provide substantial improvements in attainable signal-to-noise ratio, detection limit, and accuracy of molecular-beam/mass-spectrometer system.

**B85-10317  
FOURIER-TRANSFORM INFRARED SPECTROMETER**

R. A. SCHINDLER (Caltech)

Jan. 1986

NPO-16431

Vol. 9, No. 3, P. 73

Fourier-transform spectrometer provides approximately

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hundredfold increase in luminosity at detector plane over that achievable with older instruments of this type. Used to analyze such weak sources as pollutants and other low-concentration substances in atmosphere. Interferometer creates fringe patterns on two distinct arrays of light detectors, which observe different wavelength bands. Objective lens focuses scene on image plane, which contains optical chopper. To make instrument less susceptible to variations in scene under observation, field and detector lenses focus entrance aperture, rather than image, onto detector array.

**B85-10318**  
**CONTACTLESS CALORIMETRY FOR LEVITATED SAMPLES**

M. C. LEE (Caltech) and W. DOKKO (Caltech)

Jan. 1986

**NPO-16448**

**Vol. 9, No. 3, P. 74**

Temperature and specific heat of hot sample measured with pyrometer in proposed experimental technique. Technique intended especially for contactless calorimetry of such materials as undercooled molten alloys, samples of which must be levitated to prevent contamination and premature crystallization. Contactless calorimetry technique enables data to be taken over entire undercooling temperature range with only one sample. Technique proves valuable in study of undercooling because difference in specific heat between undercooled-liquid and crystalline phases at same temperature provides driving force to convert metastable undercooled phase to stable crystalline phase.

**B85-10319**  
**LONG-GAIN-LENGTH, SOLAR-PUMPED BOX LASER**

R. J. DE YOUNG

Jan. 1986

**LAR-13256**

**Vol. 9, No. 3, P. 74**

New laser cavity configuration efficiently couples solar radiation to laser mode volume. Lasing output powers of approximately 300 mW achieved for durations of 150 ms. New system allows lasing at substantially lower solar simulator intensities (150 Suns) and much longer laser gain lengths (60 cm).

**B85-10320**  
**OPTICAL SCANNER FOR LINEAR ARRAYS**

M. W. FINKEL

Jan. 1986

**GSC-12897**

**Vol. 9, No. 3, P. 75**

Optical scanner instantaneously reads contiguous lines forming scene or target in object plane. Reading active or passive and scans, continuous or discrete. Scans essentially linear with scan angle and symmetric about axial ray. Nominal focal error, resulting from curvature of scan, well within Rayleigh limit. Scanner specifically designed to be fully compatible with general requirements of linear arrays.

**B85-10321**  
**METHANE DETECTOR WITH PLASTIC FRESNEL LENS**

W. B. GRANT (Caltech)

Jan. 1986

**NPO-16284**

**Vol. 9, No. 3, P. 76**

Laser detector for natural gas leaks modified by substitution of molded plastic lens for spherical mirror. By measuring relative attenuation at two wavelengths, detector used to check for methane escaping from pipelines above or below ground and from landfill.

**B85-10322**  
**REFLECTING SLIT FOR IMAGING SPECTROMETER**

N. A. PAGE (Caltech), R. E. PARKS (Caltech), and J. M. RODGERS (Caltech)

Jan. 1986

**NPO-16408**

**Vol. 9, No. 3, P. 78**

Optical slit that reflects rather than transmits performs multiple functions for imaging infrared spectrometer. Serves as field reflector, field flattener, and entrance aperture for

instrument. Reflecting slit narrow strip of spherical reflecting surface with intersecting spherical reflecting side surfaces that reject radiation originating outside slit region. Precision of slit geometry crucial in optical system.

**B85-10323**  
**LASER ALTIMETER FOR FLIGHT SIMULATOR**

L. D. WEBSTER

Jan. 1986

**ARC-11312**

**Vol. 9, No. 3, P. 79**

Height of flight-simulator probe above model of terrain measured by automatic laser triangulation system. Airplane simulated by probe that moves over model of terrain. Altitude of airplane scaled from height of probe above model. Height measured by triangulation of laser beam aimed at intersection of model surface with plumb line of probe.

**B85-10324**  
**LASER PHOTOACOUSTIC TECHNIQUE DETECTS PHOTO-OXIDATION**

R. H. LIANGE (Caltech), D. R. COULTER (Caltech), and A. GUPTA (Caltech)

Jan. 1986

**NPO-16108**

**Vol. 9, No. 3, P. 80**

Laser photoacoustic instrument detects small amounts of oxidation in polymers. Instrument used to evaluate resistance to oxidation in Sunlight of polymer encapsulants for solar-cell arrays. With instrument, researchers monitor samples for early stages of photooxidation and study primary mechanisms of oxidation and degradation. Effects of these mechanisms masked during later stages.

**B85-10325**  
**OPTICAL INTEGRATING SPHERE FOR VACUUM ULTRAVIOLET**

C. L. BUTNER

Jan. 1986

**GSC-12849**

**Vol. 9, No. 3, P. 80**

Optical integrating sphere with integral sliding sample holder saves time by allowing radiometric measurements made on each of four samples without breaking vacuum. Designed to operate with interior evacuated so dye samples illuminated with short-wavelength ultraviolet strongly absorbed by air; need not be evacuated when using longer wavelengths. Device mounts on monochromator and evacuated through port that admits light from monochromator.

**B85-10326**  
**LASER SCHLIEREN CRYSTAL-GROWTH IMAGER**

R. B. OWEN and M. H. JOHNSTON

Jan. 1986

**MFS-28060**

**Vol. 9, No. 3, P. 81**

Crystal observed as it grows from melt with aid of laser schlieren imaging. Observation method allows entire perimeter of growing crystal to be inspected. Isolated crystal facets examined, convection flows and temperature and concentration gradients revealed. Method does not require contact with, or proximity to, crystal.

**B85-10327**  
**CALCULATING ATMOSPHERIC EFFECTS IN SATELLITE IMAGERY**

D. J. DINER (Caltech) and J. V. MARTONCHIK (Caltech)

Jan. 1986

**NPO-16373**

**Vol. 9, No. 3, P. 82**

Report presents detailed analysis of atmospheric blurring inherent in photographs or other observations of Earth from satellites or aircraft. Blurring result of scattering of radiation, which diffuses sharp image features by causing light from one part of scene to fall on image of adjacent part. In contrast with earlier approaches to atmospheric optics, one presented in report more accurate and versatile and designed for use on minicomputers.

B85-10328

**ALGORITHMS FOR COASTAL-ZONE COLOR-SCANNER DATA**

(Innovator Not Given) (Nimbus-7 Project Office) Jan. 1986

GSC-12852

Vol. 9, No. 3, P. 83

Software for Nimbus-7 Coastal-Zone Color-Scanner (CZCS) derived products consists of set of scientific algorithms for extracting information from CZCS-gathered data. Software uses CZCS-generated Calibrated Radiance-Temperature (CRT) tape as input and outputs computer-compatible tape and film product.

B85-10329

**DESIGNING ECCENTRIC APERTURE OPTICAL SYSTEMS**

J. R. ROGERS (University of Arizona)

Jan. 1986

NPO-16355

Vol. 9, No. 3, P. 83

Computer program aids in design of eccentric aperture optical systems by predicting vector aberration that occurs in optical system having tilted or decentered optical elements. Computer program incorporates vector theory of aberrations.

B85-10462

**PLOTTING LIGHTNING-STROKE DATA**

F. B. TATOM and R. A. GARST

Mar. 1986

MFS-26019

Vol. 9, No. 4, P. 80

Data on lightning-stroke locations become easier to correlate with cloudcover maps with aid of new graphical treatment. Geographic region divided by grid into array of cells. Number of lightning strokes in each cell tabulated, and value representing density of lightning strokes assigned to each cell. With contour-plotting routine, computer draws contours of lightning-stroke density for region. Shapes of contours compared directly with shapes of storm cells.

B85-10463

**NEBULIZATION REFLUX CONCENTRATOR**

W. R. COFER and V. G. COLLINS (College of William and Mary)

Mar. 1986

LAR-13254

Vol. 9, No. 4, P. 82

Nebulization reflux concentrator extracts and concentrates trace quantities of water-soluble gases for subsequent chemical analysis. Hydrophobic membrane and nebulizing nozzles form scrubber for removing trace quantities of soluble gases or other contaminants from atmosphere. Although hydrophobic membrane virtually blocks all transport of droplets, it offers little resistance to gas flow; hence, device permits relatively large volumes of gas scrubbed efficiently with very small volumes of liquid. This means analyzable quantities of contaminants concentrate in extracting solutions in much shorter times than with conventional techniques.

B85-10464

**TRACKING SYSTEM FOR INFRARED SPECTROMETER**

R. A. JOHNSON (Caltech), C. R. WEBSTER (Caltech), R. T. MENZIES (Caltech), G. B. MORRISON (Caltech), and J. H. RICCIO (Caltech)

Mar. 1986

NPO-16440

Vol. 9, No. 4, P. 83

Visible laser tracking system for infrared laser spectrometer keeps probe infrared laser beam aimed at moving reflector, thereby keeping reflector image and return laser beam within spectrometer field of view. System includes tracking mirror tilted by stepping motors under microprocessor control to deflect beams toward continually changing reflector position.

B85-10465

**DETERMINING THE TEMPERATURE PROFILE IN A CYLINDRICAL SAMPLE**

J. C. CLAYTON (Semtec, Inc.)

Mar. 1986

MFS-26013

Vol. 9, No. 4, P. 84

Power-series solution extrapolates from axial temperature profile. Thermal profile in homogeneous axisymmetric body determined throughout body if axial temperature profile known at any radius. New theory developed as aid in research on growth of mercury cadmium telluride for infrared detectors. In particular, applicable to Bridgman-Stockbarger growth, in which round cylindrical ampoule of molten ternary semiconductor is solidified directionally, from one end to other.

B85-10466

**INTENSE SOURCE OF POLARIZED HYDROGEN ATOMS**

L. MALEKI (Caltech)

Mar. 1986

NPO-16434

Vol. 9, No. 4, P. 85

Atoms produced by radio-frequency dissociation of hydrogen molecules sorted according to their hyperfine states in improved polarized hydrogen source. By use of combination of dc magnetic fields, atoms of upper hyperfine ground level selected in numbers greater than those of undesired  $F = 0$  state. Source built with permanent magnets or electromagnets. Principal utility is source of polarized hydrogen for masers or experimental studies.

B85-10467

**MOLECULAR THERMAL-ELECTRON DETECTORS**

A. CHUTJIAN (Caltech) and S. ALAJAJIAN (Caltech)

Mar. 1986

NPO-16300

Vol. 9, No. 4, P. 85

Low-energy electrons detected with high resolution and sensitivity by their collisions with certain molecules. In thermal-electron-detection application, ambient plasma swept into collision chamber. Chamber designed to reduce stray electric fields to negligible levels and prevent inelastic and superelastic collisions with walls of collision-chamber repeller element. Instrument based on molecular detection performs high-resolution threshold photoelectron spectroscopy. Also used to detect fluorocarbons and chlorocarbons in upper atmosphere by their interaction with thermal electrons.

B85-10468

**DETECTING TRACE CONTAMINANTS IN THE ATMOSPHERE**

S. K. SRIVASTAVA (Caltech)

Mar. 1986

NPO-16225

Vol. 9, No. 4, P. 86

Sensitive instrument uses two low-energy electron beams to detect certain molecules. Experimental instrument identifies and measures trace contaminants in atmosphere. When fully developed, portable instrument expected to measure contaminant concentrations of certain halogen containing molecules as low as one part per trillion. Instrument employs electron beams to ionize contaminant molecules by dissociative attachment of electrons.

B85-10469

**SOLID-STATE DETECTOR FOR TRACE MATERIALS**

J. J. LAMBE (Caltech), S. KHANNA (Caltech), A. P. THAKOOR (Caltech), and H. G. LEDUC (Caltech)

Mar. 1986

NPO-16450

Vol. 9, No. 4, P. 88

Detector for trace chemicals senses as few as 10 to the 12th power molecules of given material on surface. Contains no moving parts, amenable to large-scale integration, and operates at room temperature. Potential applications in industrial process control and in environmental analysis. Characteristic signals indicate presence of certain chemicals.

B85-10470

**TECHNIQUE FOR MEASURING GAS CONVERSION FACTORS**

J. J. SINGH and D. R. SPRINKLE

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Mar. 1986 See Also (N83-33127)

**LAR-13220**

**Vol. 9, No. 4, P. 90**

Technique for measuring calibration conversion factors for hydrocarbon mass flowmeters applied to widely used type of commercial thermal mass flowmeter for hydrocarbon gases. Values of conversion factors for two common hydrocarbons measured using this technique in good agreement with empirical values cited by manufacturer. Similar agreement expected for all other hydrocarbons. Technique based on Nernst theorem for matching partial pressure of oxygen in combustion product gases with that in normal air. Simple, quick, and relatively safe, particularly for toxic/poisonous hydrocarbons.

**B85-10471**

**COMPACT IMAGING SPECTROMETER**

J. B. WELLMAN (Caltech), A. F. H. GOETZ (Caltech), M. HERRING (Caltech), and G. A. VANE (Caltech)

Mar. 1986

**NPO-16342**

**Vol. 9, No. 4, P. 91**

Imaging spectrometer for use in crop and mineral resource-mapping experiments is scaled-down version. Compact imaging spectrometer uses Schmidt/Littrow optics with single spherical primary mirror. Radiation from scene strikes reflecting Schmidt corrector plate located near center of curvature of primary spherical mirror.

**B85-10472**

**LIQUID-LEVEL SENSOR FOR CONTAINERS IN MOTION**

J. J. SINGH and G. H. MALL (Computer Sciences Corp.)

Mar. 1986 See Also (N84-17560)

**LAR-13327**

**Vol. 9, No. 4, P. 92**

Nonintrusive technique monitors fluid contents of sealed vessels, regardless of fluid distribution inside vessels. Technique based on differences in cesium-137 gamma-ray attenuation coefficients in air and test liquids. Used to measure fluid content in closed containers on high-maneuvering aircraft where accelerations cause fluid to become distributed throughout container.

**B85-10473**

**HYBRID LASER WOULD COMBINE POWER WITH EFFICIENCY**

D. L. SIPES, JR. (Caltech)

Mar. 1986

**NPO-16173**

**Vol. 9, No. 4, P. 93**

Efficient laser system constructed by using two semiconductor lasers to pump neodymium yttrium aluminum garnet (Nd:YAG) device. Hybrid concept allows digital transmission at data rates of several megabits per second with reasonably sized optical aperture of 20 cm. Beams from two GaAs lasers efficiently coupled for pumping Nd:YAG crystal. Combination of lasers exploits best features of each.

**B85-10474**

**WEDGED FIBERS SUPPRESS FEEDBACK OF LASER BEAM**

I. LADANY (RCA Corp.)

Mar. 1986

**LAR-13074**

**Vol. 9, No. 4, P. 94**

When injected laser is coupled into optical fiber, emission instabilities arise because of optical feedback losses from fiber into laser. Coupling efficiencies as high as 80 percent, however, obtained by shaping end of multimode fiber into obtuse-angled wedge. Because slanted sides eliminate back reflection, such wedged fiber achieves high coupling efficiency.

**B85-10475**

**DETERMINING CALIBRATION CONSTANTS FOR ATTITUDE MEASUREMENTS**

P. TCHENG and T. D. FINLEY

Mar. 1986

**LAR-13214**

**Vol. 9, No. 4, P. 95**

Algorithm based on method of least squares determines calibration constants of seismic instruments for precise

attitude measurements. Algorithm programmed and run successfully on commercially available desk-top computer. Simplifies determinations of accelerometer calibration constants, and used in field to verify accelerometer stability.

**B85-10476**

**ACCURACY OF LIDAR MEASUREMENTS OF THE ATMOSPHERE**

M. J. KAVAYA (Caltech) and R. T. MENZIES (Caltech)

Mar. 1986 See Also (N84-28067)

**NPO-16493**

**Vol. 9, No. 4, P. 96**

Report reviews sources of systematic error in laser radar (lidar) measurements of particles in atmosphere. Report applies particularly to stationary pulsed carbon dioxide lidars of type used to measure backscatter from aerosols in troposphere. Provides information for calibrating such systems accurately and consistently and interpreting their data correctly. Also useful in calibrating mobile and airborne lidars, lidars operating at wavelengths other than those of carbon dioxide lasers, and continuous-wave lidars.

**B85-10477**

**ADSORPTION OF H<sub>2</sub>, NE, AND N<sub>2</sub> ON ACTIVATED CHARCOAL**

C. K. CHANG (Caltech), E. TWARD (Caltech), and K. I. BOUDAIE (Caltech)

Mar. 1986

**NPO-16329**

**Vol. 9, No. 4, P. 97**

9-page report presents measured adsorption isotherms of hydrogen, neon, and nitrogen on activated charcoal for temperatures from 77 to 400 K and pressures from 1 to 80 atmospheres (0.1 to 8.1 MPa). Heats of adsorption calculated from isotherms also presented. Report gives expressions, based on ideal-gas law, which show relationship between different definitions of volume of gas adsorbed and used in describing low-pressure isotherms.

**B85-10478**

**MICROWAVE ATMOSPHERIC-PRESSURE SENSOR**

D. A. FLOWER (Caltech), G. E. PECKHAM (Caltech), and W. J. BRADFORD (Caltech)

Mar. 1986

**NPO-16496**

**Vol. 9, No. 4, P. 97**

Report describes tests of microwave pressure sounder (MPS) for use in satellite measurements of atmospheric pressure. MPS is multifrequency radar operating between 25 and 80 GHz. Determines signal absorption over vertical path through atmosphere by measuring strength of echoes from ocean surface. MPS operates with cloud cover, and suitable for use on current meteorological satellites.

**B85-10479**

**SOIL/STRUCTURE INTERACTIONS IN EARTHQUAKES**

G. W. RAMEY (Auburn University), R. K. MOORE (Auburn University), C. H. YOO (Auburn University), T. D. BUSH, (Auburn University), and J. M. STALLINGS (Auburn University)

Mar. 1986

**MFS-27078**

**Vol. 9, No. 4, P. 97**

In effort to improve design of Earthquake-resistant structures, mathematical study undertaken to simulate interactions among soil, foundation, and superstructure during various kinds of vibrational excitation. System modeled as three lumped masses connected vertically by springs, with lowest mass connected to horizontal vibrator (representing ground) through springs and dashpot. Behavior of springs described by elastic or elastoplastic force/deformation relationships. Relationships used to approximate nonlinear system behavior and soil/foundation-interface behavior.

**B85-10480**

**EQUIPMENT FOR MICROGRAVITY RESEARCH**

J. A. FOUNTAIN

Mar. 1986

**MFS-27094**

**Vol. 9, No. 4, P. 98**

Illustrated catalog describes equipment and facilities available for experiments under low-gravity conditions. Catalog encourages scientific and commercial organizations to investigate benefits of conducting research and manufacturing activities in microgravity environment. Catalog covers equipment ranging from containers to spacecraft.

**B85-10481**  
**CALCULATION OF MACROSEGREGATION IN AN INGOT**  
 D. R. POIRIER (General Electric Co.) and A. L. MAPLES (General Electric Co.)  
 Mar. 1986 See Also (N84-23752)  
**MFS-27068**

**Vol. 9, No. 4, P. 98**

Report describes both two-dimensional theoretical model of macrosegregation (separating into regions of discrete composition) in solidification of binary alloy in chilled rectangular mold and interactive computer program embodying model. Model evolved from previous ones limited to calculating effects of interdendritic fluid flow on final macrosegregation for given input temperature field under assumption of no fluid in bulk melt.

**B85-10482**  
**KINEMATIC STIRLING ENGINE PERFORMANCE**

J. R. C. TEW

Mar. 1986

**LEW-14092**

**Vol. 9, No. 4, P. 99**

Computer program developed for analyzing thermodynamic characteristics of kinematic Stirling engine. Computes time-varying piston positions, pressures, and gas temperatures in each of gas-control volumes into which engine working space is divided. Engine performance characterized by calculations of power and efficiency (both indicated and brake). Inputs to code are engine geometrical parameter, engine-operating conditions, and indexes that specify various options available.

**B85-10483**  
**X-RAY DIFFRACTION ANALYSIS PROGRAM**

K. E. WIEDEMANN (Vigyan Research Associates, Inc.), J. UNNAM (Vigyan Research Associates, Inc.), S. V. N. NAIDU (Virginia Polytechnic Institute & State University), and C. R. HOUSKA (Virginia Polytechnic Institute & State University)  
 Mar. 1986

**LAR-13276**

**Vol. 9, No. 4, P. 99**

SOPAD separates overlapping peaks and analyzes derivatives of X-ray diffraction data. SOPAD helps analyst get most information out of available diffraction data. SOPAD uses Marquardt-type nonlinear regression routine to refine initial estimates of individual peak positions, intensities, shapes, and half-widths.

## 04 MATERIALS

**B85-10060**  
**HIGH-PURITY SILICON SEEDS FOR SILANE PYROLYSIS**  
 G. C. HSU (CALTECH), N. K. ROHATGI (CALTECH), and A. MORRISON (CALTECH)

Jun. 1985

**NPO-16287**

**Vol. 9, No. 1, P. 90**

Seed particles for fluidized-bed production of silicon made by new contamination-free, economical method. In new method, large particles of semiconductor-grade silicon fired at each other by high-speed streams of gas and thereby break up into particles of suitable size for fluidized bed. No foreign materials introduced, and leaching unnecessary. Method used to feed fluidized-bed reactor for continuous production of high-purity silicon.

**B85-10061**  
**THERMOSETTING PHTHALOCYANINE POLYMERS**  
 G. FOHLEN, J. PARKER, and B. ACHAR (National Research Council)  
 Jun. 1985

**ARC-11511**

**Vol. 9, No. 1, P. 91**

Group of phthalocyanine polymers resist thermal degradation. Polymers expected semiconducting. Principal applications probably in molded or laminated parts that have to withstand high temperatures. Polymers made from either of two classes of monomer: Bisphthalonitriles with imide linkages or Bisphthalonitriles with ester-imide linkages.

**B85-10062**  
**INCREASING FIRE SAFETY OF EPOXIES**

D. A. KOURTIDES and J. A. MIKROYANNIDIS (University of Patras, Greece)

Jun. 1985

**ARC-11506**

**Vol. 9, No. 1, P. 94**

Epoxy with increased resistance to fire made by reacting any of three commercial epoxide monomers with curing agent consisting of mixture of isomers called 'DCEPD'. Curing agent incorporates phosphorus and chlorine directly into crosslinking part of polymer. DCEPD produced by nitrating precursor phosphonylmethyl benzene, then reducing resulting isomeric mixture of dinitro compounds.

**B85-10063**  
**CERAMIC COATINGS FOR ENGINE PARTS**

J. E. SCHROEDER (CALTECH)

Jun. 1985

**NPO-16228**

**Vol. 9, No. 1, P. 94**

In manufacturing concept, dense, nonporous ceramic coatings applied to metal parts by plasma spraying. Coatings improve resistance of parts to corrosion and erosion in turbines and other engines. Plasma spraying faster and cheaper than previously used method, vapor deposition, and used on large parts as well as small ones.

**B85-10064**  
**HIGH-PERFORMANCE FILLETING AND CHANNEL SEALANTS**

R. W. ROSSER, D. I. BASIULIS (Hughes Aircraft Co.), and D. P. SALISBURY (Hughes Aircraft Co.)

Jun. 1985

**ARC-11408; ARC-11409**

**Vol. 9, No. 1, P. 95**

Filleting and channel sealants developed for sealing cavities in wings and fuselage of aircraft. Both sealants function well at 177 degrees C, as required in current specifications for supersonic aircraft. Sealants have excellent resistance to fuel and other solvents. They stay flexible, resistant to vibrational, thermal, and mechanical stresses, and adhere well to aluminum. Prove useful in industrial applications requiring resistance to solvents at high temperatures.

**B85-10065**  
**PURIFYING ALUMINUM BY VACUUM DISTILLATION**

E. R. DU FRESNE (CALTECH)

Jun. 1985

**NPO-16114**

**Vol. 9, No. 1, P. 96**

Proposed method for purifying aluminum employs one-step vacuum distillation. Raw material for process impure aluminum produced in electrolysis of aluminum ore. Impure metal melted in vacuum. Since aluminum has much higher vapor pressure than other constituents, boils off and condenses on nearby cold surfaces in proportions much greater than those of other constituents.

**B85-10066**  
**FOAM INSULATION FOR CRYOGENIC FLOWLINES**

T. R. SONJU (Federal-Mogul Corp.), R. L. CARBONE (Federal-Mogul Corp.), and R. E. OVES (Federal-Mogul Corp.)

Jun. 1985

**MSC-20552**

**Vol. 9, No. 1, P. 96**

## 04 MATERIALS

Welded stainless-steel vacuum jackets on cryogenic ducts replaced by plastic foam-insulation jackets that weigh 12 percent less. Foam insulation has 85 percent of insulating ability of stainless-steel jacketing enclosing vacuum of 10 microns of mercury. Foam insulation easier to install than vacuum jacket. Moreover, foam less sensitive to damage and requires minimal maintenance. Resists vibration and expected to have service life of at least 10 years.

**B85-10067**  
**SHIELDING AGAINST INTENSE LASER BEAMS**  
J. E. SCHROEDER (CALTECH)

Jun. 1985  
NPO-16186 Vol. 9, No. 1, P. 97

Multiple-layer shielding proposed to protect equipment against damage by intense infrared laser beams. New shielding concept reduces effect of destructive phase changes upon reflectance by allowing exposure of additional reflecting layers after overlaying layers vaporized.

**B85-10068**  
**SILICONE COATING ON POLYIMIDE SHEET**  
J. J. PARK

Jun. 1985  
GSC-12913 Vol. 9, No. 1, P. 98

Silicone coatings applied to polyimide sheeting for variety of space-related applications. Coatings intended to protect flexible substrates of solar-cell blankets from degradation by oxygen atoms, electrons, plasmas, and ultraviolet light in low Earth orbit and outer space. Since coatings are flexible, generally useful in forming flexible laminates or protective layers on polyimide-sheet products.

**B85-10069**  
**MELT STIRRING BY HORIZONTAL CRUCIBLE VIBRATION**

M. F. WOLF (Stanford University), D. ELWELL (Stanford University), and R. S. FEIGELSON (Stanford University)

Jun. 1985  
MFS-26005 Vol. 9, No. 1, P. 98

Horizontal vibration suggested as technique for more effective stirring of melts in crystal-growth apparatus. Vibrational technique may replace accelerated crucible rotation. Potential superiority of vibrational technique shown by preliminary experiments in which ink stirred into water.

**B85-10070**  
**NONYELLOWING POLYCARBONATE FOR OUTDOOR USE**

A. GUPTA (CALTECH), R. H. LIANG (CALTECH), A. YAVROUIAN (CALTECH), and A. CLAYTON (CALTECH)

Jun. 1985  
NPO-15836 Vol. 9, No. 1, P. 99

Two-step photochemical process prevents yellowing of polycarbonate plastics. Use of polycarbonate plastics growing in windows, aircraft glazing, and streetlight globes. New photochemical process causes formation of stabilizers bound to polymer chains and therefore cannot be leached out.

**B85-10071**  
**REVERSING GLASS WETTABILITY**

D. O. FRAZIER, J. E. SMITH JR., and W. F. KAUKLER

Jun. 1985  
MFS-26006 Vol. 9, No. 1, P. 100

Treatment reverses wettability of glassware: Liquids that normally wet glass no longer do, and those that do not wet glass are made to do so. Useful in research on container effects in nucleation and growth of secondary phase from solution. Treatment consists of spreading 3 percent (by weight) solution of silicone oil in hexane isomers over glass, drying in air, and curing at 300 degrees C in vacuum for one hour.

**B85-10072**  
**RESIN CHARACTERIZATION IN CURED COMPOSITE**

## MATERIALS

P. R. YOUNG and A. CHANG (Kentron International, Inc.)  
Jun. 1985

LAR-13172 Vol. 9, No. 1, P. 103

Molecular-level characterization of polymeric matrix resin in cured graphite-reinforced composite materials now determined through analysis of diffuse reflectance (DR) with Fourier Transform Infrared (FTIR) spectroscopy. Improved analytical method based on diffuse reflectance. DR/ FTIR technique successfully applied to analysis of several different composites and adhesives impossible to analyze by conventional methods.

**B85-10073**  
**EFFICIENT PROCESS FOR MAKING POLYCRYSTALLINE SILICON**

J. R. MCCORMICK (Dow Corning Corp.), F. PLAHUTNIK JR. (Dow Corning Corp.), D. H. SAWYER (Dow Corning Corp.), A. N. ARVIDSON (Dow Corning Corp.), and S. M. GOLDFARB (Dow Corning Corp.)

Jun. 1985  
NPO-16121 Vol. 9, No. 1, P. 104

Solar cells made with lower capital and operating costs. Process based on chemical-vapor deposition (CVD) of dichlorosilane produces high-grade polycrystalline silicon for solar cells. Process has potential as cost-effective replacement for CVD of trichlorosilane.

**B85-10074**  
**SYNTHESIZING METAL PHTHALOCYANINE IMIDE POLYMERS**

B. ACHAR, G. FOHLEN, and J. PARKER

Jun. 1985  
ARC-11413 Vol. 9, No. 1, P. 105

Efficient synthesis of analytically-pure metal (II) 4,4',4'', 4''' tetraaminophthalocyanine demonstrated in experiments. Typical Polymerization proceeds in two steps: First, reaction with 3,3',4,4''-benzophenonetetracarboxylic dianhydride. Second step cyclodehydration. New polymers expected useful in formulation of thermally stable varnishes, adhesives, and fibers.

**B85-10075**  
**SOLAR-ASSISTED OXIDATION OF TOXIC CYANIDE**

C. E. BYVIK and A. MILES (Southern University)

Jun. 1985  
LAR-13171 Vol. 9, No. 1, P. 106

In solar-assisted oxidation technique, oxygen-bearing air bubbled through cyanide solution in which platinized powdered TiO<sub>2</sub> is suspended. Light from either artificial source or natural Sunlight irradiates. Experiments demonstrated this technique effective in reducing concentration of cyanide to levels well below those achieved by other methods. Results suggest effective and inexpensive method for oxidizing cyanide in industrial wastewaters.

**B85-10076**  
**ETHYNYL-TERMINATED ESTER OLIGOMERS AND POLYMERS**

P. M. HERGENROTHER and S. J. HAVENS (Kentron International, Inc.)  
Jun. 1985

LAR-13118 Vol. 9, No. 1, P. 107

Polyesters of various molecular weights terminated with ethynyl groups. As ethynyl-terminated polyesters are exposed to elevated temperatures, thermally induced reaction of ethynyl groups occurs to provide cross-linking and chain extension. Reaction raises use temperature of polymer and greatly improves resistance to solvents. New materials produced by this process potentially useful as adhesives, composite matrices, solvent-resistant coatings, membranes, and films.

**B85-10077**  
**STATIC-SUPPRESSING OPTICAL PAINT**

M. M. BIRNBAUM (CALTECH), E. C. METZLER (CALTECH),

and E. L. CLELAND (CALTECH)

Jun. 1985  
NPO-15992

Vol. 9, No. 1, P. 107

Electrically conductive flat black paint adheres well to magnesium, aluminum, fiberglass, and other materials. Paint absorbs stray light in optical instruments while preventing buildup of electrostatic fields and arcing. Paint consists of primer and topcoat, both containing electrically conductive carbon-black powder. Primer two-part epoxy base, and topcoat polyurethane base.

**B85-10078  
IMPROVING EMITTANCE OF HIGH-TEMPERATURE INSULATING TILE**

E. R. GZOWSKI (Lockheed Missiles & Space Company, Inc.)

Jun. 1985

MSC-20714

Vol. 9, No. 1, P. 108

Simple addition to ceramic insulating tiles provides backup properties that minimize transfer of heat through tiles when their surfaces become damaged. Addition of 3 percent by weight of 320 or 600-grit silicon carbide powder to ceramic during production results in impregnated tile material that resists overheating. Silicon carbide increases emittance and decreases transmittance of ceramic.

**B85-10079  
RUBBERIZED, BROMINATED EPOXIES**

W. GILWEE, D. KOURTIDES, J. PARKER, and Z. NIR (National Research Council)

Jun. 1985

ARC-11427

Vol. 9, No. 1, P. 109

Graphite/epoxy composite materials made with resins containing bromine and rubber additives. New composites tougher and more resistant to fire. Flame resistance increased by introducing bromine via commercial brominated flame-retardant polymeric additives.

**B85-10080  
WATERPROOFING AGENTS FOR SILICA TILES**

H. N. NAKANO (Lockheed Missiles & Space Co., Inc.), Y. D. IZU (Lockheed Missiles & Space Co., Inc.), and E. N. YOSHIOKA (Lockheed Missiles & Space Co., Inc.)

Jun. 1985

MSC-20364

Vol. 9, No. 1, P. 109

Waterproofing agent methyltrimethoxysilane applied to silica thermal insulation tiles in simple vapor-deposition process. Other waterproofing agents in same series include methylsiloxane and hexamethyldisilazane. Originally developed for insulating tiles for spacecraft, agents also find uses in roofing tiles, insulation for buildings or solar-energy systems, or solar reflectors.

**B85-10081  
PREPARATION AND CHARACTERIZATION OF HGXCD1-XTE**

J. BROERMAN (McDonnell Douglas Corp.), B. MORRIS (McDonnell Douglas Corp.), and P. MESCHTER (McDonnell Douglas Corp.)

Jun. 1985

MFS-27037

Vol. 9, No. 1, P. 110

Experimental studies of growth of Hg<sub>x</sub>Cd<sub>1-x</sub>Te important as infrared detector material. Studies part of greater effort to determine effects of processing conditions on chemical, physical, and electrical properties of this material.

**B85-10082  
STRENGTH OF GRAPHITE/METAL COMPOSITE LAP JOINTS**

A. ELLISON (Lockheed Missiles & Space Co., Inc.) and D. KINTIS (Lockheed Missiles & Space Co., Inc.)

Jun. 1985

MFS-27030

Vol. 9, No. 1, P. 110

Report presents results of tests on fastened lap joints between strips of graphite/aluminum and graphite/magnesium composites. Goal of test program was to

establish practical load range and effect of such joint parameters as load direction relative to graphite fiber direction, edge distance, fastener diameters, and lateral spacing as function of net section efficiency.

**B85-10083  
PREDICTING EFFECTS OF IMPACTS ON CONFINED EXPLOSIVES**

C. K. CHAN (CALTECH)

Jun. 1985

NPO-16258

Vol. 9, No. 1, P. 111

Study aimed at improving safety of explosive storage examined relationship between small-scale experiments and actual explosions. Object of study to develop scaling laws that eliminate need for full-scale explosion tests and reduce need for small-scale tests. Results of study make it possible to predict explosive behavior from small tests and numerical simulation.

**B85-10084  
FURTHER TESTS OF 38 BALL-BEARING GREASES**

E. MCMURTREY

Jun. 1985 See Also NASA TM-82533(N83-31020/NSP)

MFS-27043

Vol. 9, No. 1, P. 111

Interim report presents recent results in program of long-term testing of ball-bearing greases in vacuum, oxidizing, and otherwise hostile environments. Class of lubricants based on perfluoroalkylpolyether (PFPE) gave best results in vacuum operation in both 1-year and 5-year tests.

**B85-12192  
FILAMENT GUIDES FOR SILICON-RIBBON GROWTH**

A. D. MORRISON (Caltech)

Oct. 1985

NPO-16306

Vol. 9, No. 2, P. 88

Contamination reduced in modified growth system. In Silicon-ribbon growth apparatus, capillary filament guides are integral parts of crucible, extending from bottom to top of melt. Addition of guides expected to result in better thermal control of growth process and higher silicon purity.

**B85-10193  
LIGHTWEIGHT ELECTRICAL INSULATION**

J. E. SCHROEDER (Caltech)

Oct. 1985

NPO-16165

Vol. 9, No. 2, P. 92

Hollow plastic spheres expanded and fused together. Hollow, gasfilled plastic spheres piled in mold. Heating in vacuum softens and expands spheres, forcing them together into nearly regular hexagonal close packing. Foam used as lightweight, electrically insulating material in place of solid ceramic, glass, or polymer. Padding to protect against mechanical shocks another application for such dense, regular foam.

**B85-10194  
DIFFUSELY REFLECTING PAINTS CONTAINING TFE**

M. C. SHAI and J. B. SCHUTT

Oct. 1985

GSC-12883

Vol. 9, No. 2, P. 92

Highly reflective, diffused coatings developed by incorporating polytetrafluoroethylene (TFE) pigment with alcohol-soluble binders. Alcohol and binder mixed together in blender before adding TFE. TFE preferably outgassed in mechanical-pump vacuum for typical interval of 4 hours before adding to liquid. Like wetting agent, vacuum treatment helps to prevent clumping of TFE and eases dispersion throughout mixture. Mixture blended for 3 to 5 minutes before used. Coatings useful on reflectance-standard surfaces for calibrating radiometric instruments in both laboratory and field. Paints washable and usable as optical reference surfaces.

**B85-10195  
PARAMAGNETIC PRECIPITATES MAY RAISE SUPER-CURRENT**

E. W. COLLINGS (Batelle Columbus)

## 04 MATERIALS

Oct. 1985

**MFS-25925**

**Vol. 9, No. 2, P. 94**

Addition of Mn to Ti/Nb superconducting alloy increases critical current. Adding Mn to Ti/Nb alloy has little effect on major superconducting phase, but confers strong paramagnetic susceptibility on alpha-phase particles. beta-phase particles become stronger flux pinners, resulting in increase in critical current.

**B85-10196**

**INTERCALATED-CARBON LOW-RESISTIVITY FIBERS**

A. H. YAVROUIAN (Caltech) and J. A. WOOLLAM (Caltech)

Oct. 1985

**NPO-16307**

**Vol. 9, No. 2, P. 94**

Experiments show feasibility of making lightweight, electrically conductive fibers from graphite intercalation compounds. Fibers thermally stable in air up to 100 degrees C. These materials used as ingredients in composite enclosures for electronic equipment, especially where such equipment must be both light in weight and electrically conductive for electrostatic drainage or radio-frequency suppression.

**B85-10197**

**ION IMPLANTATION IMPROVES BEARING-SURFACE PROPERTIES**

M. S. MISRA (Martin Marietta Corp.) and F. M. KUSTAS (Martin Marietta Corp.)

Oct. 1985

**MFS-25995**

**Vol. 9, No. 2, P. 95**

Selected ions fired into rolling elements to increase resistance to rolling-contact fatigue. Mask strips confine implantation to 105 degree arcs on cylindrical surfaces. Specimens kept cool by copper block through which refrigerant is circulated. Implanting nitrogen or titanium ions in metals improves resistance to fatigue, corrosion, and wear without altering bulk properties. Unlike such surface treatments as conventional nitriding, conventional carburizing, and coating, ion implantation is low-temperature process, requires no finishing operations, and produces highly-alloyed surface layer. Implantation process also helps conserve such strategic materials as chromium and cobalt by using them only where needed.

**B85-10198**

**MICROFISSURING IN ELECTRON-BEAM-WELDED NICKEL ALLOY**

J. NUNES, A.C.

Oct. 1985 See Also N83-29356

**MFS-27041**

**Vol. 9, No. 2, P. 96**

Mathematical model developed for microfissuring of commercial nickel alloy during electron-beam welding. Number of measured microfissures per unit length of weld plotted against excess power calculated by computer model. Excess power that above level likely to produce microfissures. In agreement with model, measured microfissures increase at rate of 4.5 per inch (1.8 per centimeter) per excess kilowatt.

**B85-10199**

**MEASURING HYDROGEN CONCENTRATIONS IN METALS**

M. D. DANFORD

Oct. 1985

**MFS-27020**

**Vol. 9, No. 2, P. 96**

Commercial corrosion-measurement system adapted to electrochemical determination of hydrogen concentrations in metals. New technique based on diffusion of hydrogen through foil specimen of metal. In sample holder, hydrogen produced on one side of foil, either by corrosion reaction or by cathodic current. Hydrogen diffused through foil removed on other side by constant anode potential, which leads to oxidation of hydrogen to water. Anode current is measure of concentration of hydrogen diffusing through foil. System used to study hydrogen uptake, hydrogen

elimination by baking, effect of heat treatment, and effect of electroplating on high-strength steels.

**B85-10200**

**PRODUCTION PROCESS FOR STRONG, LIGHT CERAMIC TILES**

G. R. HOLMQUIST (Lockheed Missiles & Space Co., Inc.), E. R. CORDIA (Lockheed Missiles & Space Co., Inc.), and R. S. TOMER (Lockheed Missiles & Space Co., Inc.)

Oct. 1985

**MSC-20602**

**Vol. 9, No. 2, P. 97**

Proportions of ingredients and sintering time/temperature schedule changed. Production process for lightweight, high-strength ceramic insulating tiles for Space Shuttle more than just scaled-up version of laboratory process for making small tiles. Boron in aluminum borosilicate fibers allows fusion at points where fibers contact each other during sintering, thereby greatly strengthening tiles structure.

**B85-10201**

**IMPROVED ELECTRODES FOR LITHIUM CELLS**

S. P. S. YEN (Caltech), S. SURAMPUDI (Caltech), B. J. CARTER (Caltech), and R. B. SOMOANO (Caltech)

Oct. 1985

**NPO-16397**

**Vol. 9, No. 2, P. 98**

Chlorinated elastomeric binder improves cell mechanical and electrical characteristics. Substituted for PTFE binder, chlorinated polyethylene rubber allows high cell-discharge rates and higher stored energy per unit volume. In addition, it costs about one-eighth as much as PTFE.

**B85-10202**

**FLUIDIZED-BED PARTICLES SCAVENGE SILICON FINES**

G. C. HSU (Caltech), N. ROHATGI (Caltech), R. LUTWACK (Caltech), and R. HOGLE (Caltech)

Oct. 1985

**NPO-16034**

**Vol. 9, No. 2, P. 98**

Waste reduced, and silicon production rate improved. In new process silicon formed by thermal decomposition of SiH4. Part of silicon formed on silicon seed particles as result of surface chemical reaction. However, silicon formed by homogeneous reaction in gas phase tends to form aggregates of silicon atoms, which appear as fine particles (like dust). Believed that scavenging action of seed particles enables large fraction fines to be incorporated onto seed surface. This mode of growth confirmed by electron microscopy photographs.

**B85-10203**

**BLOWING POLYMER BUBBLES IN AN ACOUSTIC LEVITATOR**

M. C. LEE (Caltech)

Oct. 1985

**NPO-16212**

**Vol. 9, No. 2, P. 100**

In new manufacturing process, small gas-filled polymer shells made by injecting gas directly into acoustically levitated prepolymer drops. New process allows sufficient time for precise control of shell geometry. Applications foreseen in fabrication of deuterium/tritium-filled fusion targets and in pharmaceutical coatings. New process also useful in glass blowing and blow molding.

**B85-10204**

**MAGNETRON-SPUTTERED AMORPHOUS METALLIC COATINGS**

A. P. THAKOOR (Caltech), M. MEHRA (Caltech), and S. K. KHANNA (Caltech)

Oct. 1985

**NPO-16221**

**Vol. 9, No. 2, P. 100**

Amorphous coatings of refractory metal/metalloid-based alloys deposited by magnetron sputtering provide extraordinary hardness and wear resistance. Sputtering target fabricated by thoroughly mixing powders of tungsten, rhenium, and boron in stated proportions and pressing at 1,200 degrees C and 3,000 lb/in. to second power (21

MPa). Substrate lightly etched by sputtering before deposition, then maintained at bias of - 500 V during initial stages of film growth while target material sputtered onto it. Argon gas at pressure used as carrier gas for sputter deposition. Coatings dense, pinhole-free, extremely smooth, and significantly resistant to chemical corrosion in acidic and neutral aqueous environments.

**B85-10205  
DETERMINING FIBER ORIENTATION IN GRAPHITE-REINFORCED COMPOSITES**

J. G. DANIELS, I. LEDBETTER, FRANKE., J. M. CLEMON, B. G. PENN, and W. T. WHITE

Oct. 1985

**MFS-28032** Vol. 9, No. 2, P. 101

Orientation of fibers in graphite-fiber-reinforced plastics easily determined with new method. Materials scientists thus ensure that fibers, usually not visible after graphite/plastic composite has been cured, properly oriented in test specimens and test results accurately represent the characteristics of composite. Method based on fact that continuous graphite fibers embedded in cured polymer matrix actually parallel conductors. Thus, resistance measured across laminate is at minimum when probes of ohmmeter connected to opposite ends of fibers.

**B85-10206  
PREDICTING THE FATIGUE LIFE OF STRUCTURES**

P. M. BESUNER (Failure Analysis Associates), D. O. HARRIS (Failure Analysis Associates), J. M. THOMAS (Failure Analysis Associates), D. E. ALLISON (Failure Analysis Associates), J. M. BANNANTINE (Failure Analysis Associates), S. B. BROWN (Failure Analysis Associates), C. S. DAVIS (Failure Analysis Associates), G. A. DERBALIAN (Failure Analysis Associates), J. W. EISCHEN (Failure Analysis Associates), G. F. FOWLER (Failure Analysis Associates) et al

Oct. 1985

**MFS-27049** Vol. 9, No. 2, P. 102

Report reviews fracture-mechanics technology for predicting life expectancy of structural components subjected to cyclic loads. Report covers analytical tools for modeling and forecasting subcritical fatigue-crack growth in structures. It emphasizes use of tools in practical, day-to-day problems of engineering design, development, and decision-making.

**B85-10207  
CORROSIVE EFFECTS OF BURNING FUELS**

J. BELLAN (Caltech) and S. ELGHOBASHI (Caltech)

Oct. 1985

**NPO-16345** Vol. 9, No. 2, P. 103

Literature synthesized to develop corrosion predictions for unconventional fuels. Report presents studies of probable corrosive effects of such unconventional fuels as liquefied coal. Report prepared by analyzing probable composition of fuels when they come into wide use, identifying important compounds, and searching literature for information about corrosion problems associated with compounds in environments like those in industrial and commercial boilers and furnaces.

**B85-10208  
SYNTHETIC ORGANIC MATERIALS IN NUCLEAR POWERPLANTS**

F. L. BOUQUET (Caltech) and J. W. WINSLOW (Caltech)

Oct. 1985

**NPO-16424** Vol. 9, No. 2, P. 103

Report aids plant designers and qualification engineers in ensuring that organic materials in nuclear powerplants will perform satisfactorily in such safety-related equipment as insulation on motor windings, pump diaphragms, motor and pump lubricants, and pump seals and gaskets. Report provides information for service that may include both mild and harsh nuclear environments.

**B85-10209  
DEGRADATION OF DIELECTRICS IN SPACE**

F. L. BOUQUET (Caltech)

Oct. 1985

**NPO-16003** Vol. 9, No. 2, P. 103

Effects of radiation (principally, electrons and protons) on dielectric materials summarized in report. Report based on radiation tests of optical coatings, temperature-control coatings, adhesives, radomes, thermal insulators, and light-control surfaces. Materials are primarily polymers and metal/organic coatings.

**B85-10210  
PLASMA DEPOSITION OF DOPED AMORPHOUS SILICON**

H. F. CALCOTE

Oct. 1985

**NPO-14955; NPO-14956** Vol. 9, No. 2, P. 104

Pair of reports present further experimental details of investigation of plasma deposition of films of phosphorous-doped amorphous silicon. Probe measurements of electrical resistance of deposited films indicated films not uniform. In general, it appeared that resistance decreased with film thickness.

**B85-10211  
BONDING SOLAR-CELL MODULES**

D. R. COULTER (Caltech), E. F. CUDDIHY (Caltech), and E. F. PLUEDDEMANN (Caltech)

Oct. 1985 See Also N84-22008

**NPO-16399** Vol. 9, No. 2, P. 104

Status of research program on chemical bonding for solar-cell arrays subject of 57-page report. Program aimed at identifying, developing, and validating weather-stable chemical bonding promoters. Materials key to ensuring long life in encapsulated photovoltaic modules for electric-power generation. To be cost-effective, modules must hold together for at least 20 years, reliably resisting delamination and separation of component materials

**B85-10212  
MODELING A TRANSIENT CATALYTIC COMBUSTOR**

J. S. TIEN (Case Western Reserve University)

Oct. 1985

**LEW-13723** Vol. 9, No. 2, P. 104

Transient model of monolith catalytic combustor presented in report done under NASA/DOE contract. Model assumes quasi-steady gas phase and thermally 'thin' solid. In gas-phase treatment, several quasi-global chemical reactions assumed capable of describing CO and unburnt hydrocarbon emissions in fuel-lean operations. In steady-state computation presented, influence of selected operating and design parameters on minimum combustor length studied. When fast transient responses required, both steady and unsteady studies made to achieve meaningful compromise in design.

**B85-10213  
PLASTIC AND FAILURE ANALYSIS OF COMPOSITES**

C. A. BIGELOW and W. S. JOHNSON

Oct. 1985

**LAR-13183** Vol. 9, No. 2, P. 105

Three-dimensional finite-element computer program called PAFAC (Plastic and Failure Analysis of Composites) developed for elastic/plastic analysis of fiber-reinforced composite materials and structures. PAFAC written in FORTRAN IV for batch execution. Particularly suited for analyzing laminated metal-matrix composites.

**B85-10214  
EXHAUST EFFLUENT DIFFUSION MODEL**

J. R. BJORKLUND (H. E. Cramer Co., Inc.), R. K. DUMBAULD (H. E. Cramer Co., Inc.), C. S. CHENEY (H. E. Cramer Co., Inc.), and H. V. GEARY (H. E. Cramer Co., Inc.)

Oct. 1985

## 04 MATERIALS

### MFS-25940 Vol. 9, No. 2, P. 105

Rocket Exhaust Effluent Diffusion Model (REEDM) predicts concentrations, dosages, and depositions downwind from normal and abnormal launches of rocket vehicles at NASA's Kennedy Space Center. REEDM written in FORTRAN IV for interactive execution.

### B85-10330 TROUGH COATING SOLAR CELLS WITHOUT SPILLOVER

J. D. HEAPS (Honeywell, Inc.)  
Jan. 1986

### NPO-15313 Vol. 9, No. 3, P. 85

Problem with trough coating of silicon on ceramic - spillover of molten silicon - overcome by combination of redesigned heaters and tiltable trough. Modifications make it possible to coat virtually any length of ceramic with film of solar-cell-grade silicon. Previously, maximum length coated before spillover occurred was 2 inches (5.1 cm).

### B85-10331 REDUCING STRESS-CORROSION CRACKING IN BEARING ALLOYS

N. E. PATON (Rockwell International Corp.), D. P. DENNIES (Rockwell International Corp.), and J. B. LUMSDEN (Rockwell International Corp.)  
Jan. 1986

### MFS-19948 Vol. 9, No. 3, P. 86

Resistance to stress-corrosion cracking in some stainless-steel alloys increased by addition of small amounts of noble metals. 0.75 to 1.00 percent by weight of palladium or platinum added to alloy melt sufficient to improve properties of certain stainless steels so they could be used in manufacture of high-speed bearings.

### B85-10332 EPOXY/FLUOROETHER COMPOSITES

R. W. ROSSER and M. S. TAYLOR (San Jose State University)  
Jan. 1986

### ARC-11418 Vol. 9, No. 3, P. 86

Composite materials made from unfilled and glass-fiber-reinforced epoxy toughened by copolymerization with elastomeric prepolymers of perfluoroalkyl ether diacyl fluoride (EDAF). Improved properties due to hydrogen bonding between rubber phase and epoxy matrix, plus formation of rubberlike phase domains that molecularly interpenetrate with epoxy matrix. With optimum rubber content, particle size, and particle shape, entire molecular structure reinforced and toughened. Improved composites also show increased failure strength, stiffness, glass-transition temperature, and resistance to water.

### B85-10333 IMIDE CYCLOTRIPOSPHAZENE/HEXAFLUOROISOPROPYLIDENE POLYMERS

G. M. FOHLEN and J. A. PARKER  
Jan. 1986

### ARC-11428 Vol. 9, No. 3, P. 88

Useful physical and chemical properties observed in compounds obtained by thermally-induced melt polymerization of maleimido-phenoxy cyclotriphosphazenes linked through hexafluoroisopropylidene-diphthalimide groups. Polymers exhibit high strength, high thermal stability, and high char yields, and appear to be excellent candidates for fabricating composite materials.

### B85-10334 MEASURING CARRIER LIFETIME IN GAAS BY LUMINESCENCE

O. VON ROOS (Caltech)  
Jan. 1986

### NPO-16337 Vol. 9, No. 3, P. 89

Luminescence proposed as nondestructive technique for measuring Shockley-Read-Hall (SRH) recombination lifetime GaAs. Sample irradiated, and luminescence escapes

through surface. Measurement requires no mechanical or electrical contact with sample. No ohmic contacts or p/n junctions needed. Sample not scrapped after tested.

### B85-10335 RESIN POWDER SLURRY PROCESS FOR COMPOSITE FABRICATION

R. A. PIKE (United Technologies Corp.)  
Jan. 1986

### LAR-13106 Vol. 9, No. 3, P. 90

Potentially useful process for fabrication of fiber-reinforced resin-matrix composites is powder slurry technique. Applicability of technique demonstrated using powdered resin made from thermoplastic polyimide LaRC/TPI (thermoplastic polyimide). Use of process circumvents need for such high-cost organic solvents as N-methylpyrrolidinone and diglyme (diglycol methyl ether). Two basic slurries for LaRC/TPI powder investigated.

### B85-10336 WATER-SOLUBLE THERMOPLASTIC POLYIMIDES

R. A. PIKE (United Technologies Corp.)  
Jan. 1986

### LAR-13105 Vol. 9, No. 3, P. 90

Several thermoplastic polyimide resins that show potential as matrix resins developed. Number of processes for composite fabrication evaluated, including powder processing, which involves deposition of resin powder on graphite fiber from nonresin-solvent slurry. Although powder slurry approach is viable, use of solvent system more amenable with current prepreg manufacturing methods.

### B85-10337 MAGNETRON SPUTTERING DEPOSITS CORROSION-RESISTANT ALLOY

S. K. KHANNA (Caltech), A. P. THAKOOR (Caltech), and R. M. WILLIAMS (Caltech)  
Jan. 1986

### NPO-15928 Vol. 9, No. 3, P. 92

Dense, amorphous, metallic film resists corrosion attack by acid. Coatings thermally stable up to 800 degrees C and made corrosion resistant by proper choice of sputtering deposition conditions. Protective, corrosion-resistant coatings applied to process equipment that comes in contact with aqueous, neutral, or acidic solutions in chemical, petroleum, and paper industries, in wastewater treatment, and in heat exchangers.

### B85-10338 CALCULATING CHARGE TRANSPORT IN SEMICONDUCTORS

C. E. BYVIK, A. M. BUONCRISTIANI (Christopher Newport College), and J. THOMCHICK (Pennsylvania State University)  
Jan. 1986

### LAR-13201 Vol. 9, No. 3, P. 92

Method, called flux method, improvement over conventional methods, easy to use, and applies in operating regime not accessible to conventional macroscopic methods. Key concept of flux method follows behavior of particle flux rather than concentration of particles. Method not subject to limitations that follow from local or infinitesimal analysis.

### B85-10339 DAMPING MELT CONVECTION WITH A MAGNETIC FIELD

R. G. PIRICH (Grumman Aerospace Corp.) and J. L. DECARLO (Grumman Aerospace Corp.)  
Jan. 1986

### MFS-28040 Vol. 9, No. 3, P. 93

Application of 3-kG magnetic field reduces thermal and solutal convection in Bi/MnBi melt in Bridgman-Stockbarger (moving-vertical-thermal-gradient) furnace operating in normal gravitational field. Resulting Bi/MnBi alloy samples had properties similar to samples grown under nearly zero gravity. New technique proves useful in grow-

ing more uniform, defect-free semiconductor materials from such other electrically conductive melts.

**B85-10340**  
**PURIFYING WATER BY IMBIBITION**  
E. A. LAWTON (Caltech)

Jan. 1986

**NPO-16419**

**Vol. 9, No. 3, P. 94**

Concept for purifying water uses absorbent material to remove organic substances. Entire bulk of material employed, not just surface. Proposed purification process uses inexpensive equipment and low energy. Material is methyl acrylate polymer. Material cheap and regenerated by rinsing with methanol or by allowing absorbed compounds to evaporate from it.

**B85-10341**  
**EXTRACTING SILICON PRODUCT FROM FLUIDIZED-BED REACTORS**

G. C. HSU (Caltech), N. K. ROHATGI (Caltech), and A. D. MORRISON (Caltech)

Jan. 1986

**NPO-16385**

**Vol. 9, No. 3, P. 96**

Silicon particles continuously removed from bottom of fluidizedbed reactor when grown to large size. In reactor, silane (SiH<sub>4</sub>) flows through bed of small silicon seed particles at temperature of 650 degrees to 700 degrees C. Silane decomposes into silicon vapor and hydrogen gas, and vapor deposits as solid on seed particles. With withdrawal system, reactor operates continuously.

**B85-10342**  
**PRODUCING SILICON CARBIDE FOR SEMICONDUCTOR DEVICES**

G. C. HSU (Caltech) and N. K. ROHATGI (Caltech)

Jan. 1986

**NPO-16391**

**Vol. 9, No. 3, P. 103**

Processes proposed for production of SiC crystals for use in semiconductors operating at temperatures as high as 900 degrees C. Combination of new processes produce silicon carbide chips containing epitaxial layers. Chips of SiC first grown on porous carbon matrices, then placed in fluidized bed, where additional layer of SiC grows. Processes combined to yield complete process. Liquid crystallization process used to make SiC particles or chips for fluidized-bed process.

**B85-10343**  
**SYNTHESIS OF METAL PHTHALOCYANINE SHEET POLYMERS**

B. N. ACHAR, G. M. FOHLEN, and J. A. PARKER

Jan. 1986

**ARC-11405**

**Vol. 9, No. 3, P. 104**

New method for synthesizing metal phthalocyanine tetracarboxylic acids (MPTCA's) yields high purity end product. In addition, high-purity metal phthalocyanine sheet polymers synthesized from compounds. Monomer formed into sheet polymer by heating. Units of polymer linked in manner similar to phenyl-group linkages in biphenyl: Conjugation extends throughout macromolecule, thereby increasing delocalization of  $\pi$ -electrons. Increases conductivity and thermal stability of polymer.

**B85-10344**  
**PREDICTING THE CYCLIC RESPONSE OF HIGH-TEMPERATURE MATERIALS**

V. MORENO (United Technologies Corp.)

Jan. 1986 See Also (N83-21390)

**LEW-14032**

**Vol. 9, No. 3, P. 105**

Simplified analytical procedure for estimating local stress/strain response in high-temperature structural component developed. Simplified procedure relies on assumption local inelastic response in high-temperature structure constrained by surrounding elastic material. Procedure assumes local response composed of elastic, time-independent

plastic, and creep components. Conventional yield surface concept used to determine onset of plastic action.

**B85-10345**  
**PROCESS FOR NONEQUILIBRIUM TERNARY ALLOYS**  
R. LUTWACK (Caltech)

Jan. 1986

**NPO-16226**

**Vol. 9, No. 3, P. 105**

Proposed metallurgical process yields amorphous ternary alloys of any range of desired compositions. Process produces homogenous alloys even when proportions of constituent metals are not those that exist in equilibrium at solidification temperature. Such alloys are well suited to use in gas turbines and advanced engines.

**B85-10346**  
**STUDYING CRYSTAL GROWTH WITH THE PELTIER EFFECT**

D. J. LARSON JR. (Grumman Aerospace Corp.), B. DRES-SLER (Grumman Aerospace Corp), R. P. SILBERSTEIN (Grumman Aerospace Corp.), and W. J. POIT (Grumman Aerospace Corp.)

Jan. 1986

**MFS-28041**

**Vol. 9, No. 3, P. 106**

Peltier interface demarcation (PID) shown useful as aid in studying heat and mass transfer during growth of crystals from molten material. In PID, two dissimilar 'metals' solid and liquid phases of same material. Current pulse passed through unidirectionally solidifying sample to create rapid Peltier thermal disturbance at liquid/solid interface. Disturbance, measured by thermocouple stationed along path of solidification at or near interface, provides information about position and shape of interface.

**B85-10347**  
**PLASMA-SPRAYED COATINGS ON POROUS SURFACES**  
C. H. LEIBERT

Jan. 1986

**LEW-13450**

**Vol. 9, No. 3, P. 107**

Need for combining benefits of duplex thermal-barrier coatings with film cooling on gas-turbine vanes and blades stimulated development of improved method for plasma spraying these coatings. Method reduces blocking of holes by plasma-sprayed material and at same time reduces base-metal oxidation during coating operation. Features provide potential for increased engine efficiency and power, reduced fuel consumption, use of less costly materials or construction procedures, and extended life and durability.

**B85-10348**  
**PHTHALOCYANINE TETRAAMINE EPOXY-CURING AGENTS**

G. M. FOHLEN, B. N. ACHAR, and J. A. PARKER

Jan. 1986

**ARC-11424**

**Vol. 9, No. 3, P. 107**

Tough fire- and chemical-resistant epoxies produced by using metalphthalocyanine tetraamines (MPT's) of copper, cobalt, or nickel as curing agents. Synthesis of MPT's commercially realizable and gives pure compounds with almost 90-percent yield. Synthesis applicable for metals with atomic radii of about 1.35 angstroms, including Cu, Co, Ni, Zn, Fe, Pt, Al, and V. Possible to use metal phthalocyanines to cure epoxy resins in homogeneous reaction.

**B85-10349**  
**IMPROVED JET-MILL SILICON GRINDER**  
E. R. COLLINS (Caltech)

Jan. 1986

**NPO-16336**

**Vol. 9, No. 3, P. 108**

Proposed refinement in jet-mill grinding of silicon reduces proportion of unusable, overly ground particles. Particles serve as seeds for growth of silicon from vapor. In new grinding apparatus, particle separator distinct from collision chamber. Particle collides only once before sorted for size. If proper size, extracted; if not, returned to chamber for another collision.

## 04 MATERIALS

**B85-10350**

### **MEASURING THERMAL DIFFUSIVITY OF MOLTEN SEMICONDUCTORS**

R. CROUCH, L. HOLLAND, and R. E. TAYLOR (Purdue University)

Jan. 1986

**MFS-28047**

**Vol. 9, No. 3, P. 110**

Thermal diffusivity of molten and solid mercury cadmium telluride measured with aid of new apparatus. Knowledge gained from such measurements help efforts to grow high-quality single crystals of this semiconductor for use in infrared detectors: Without knowledge of thermal diffusivity, difficult to control growth rate of solid from molten material.

**B85-10351**

### **MELT-PRESSED FILMS OF INSOLUBLE SEMICRYSTALLINE POLYMERS**

J. R. TYERYAR, B. J. JENSEN, and R. L. FOX

Jan. 1986

**LAR-13212**

**Vol. 9, No. 3, P. 112**

Technique known as 'melt pressing' produces films from solid, insoluble, semicrystalline polymers in less than 5 minutes. Amount of crystallinity and possibly final crystal structure of film controlled in process. Induction heating, using gapped toroidal core, melts sample. Toroidal core and capacitor form tuned circuit. Below induction heating toroid, layer of insulation prevents heat transfer from insoluble film to induction heating apparatus.

**B85-10352**

### **PROTECTIVE COATINGS FOR METALS**

D. J. RUGGIERI and A. P. ROWE

Jan. 1986

**KSC-11308**

**Vol. 9, No. 3, P. 113**

Report evaluates protective coatings for metal structures in seashore and acid-cloud environments. Evaluation result of study of coating application characteristics, repair techniques, and field performance. Products from variety of manufacturers included in study. Also factory-coated panels and industrial galvanized panels with and without topcoats.

**B85-10353**

### **DISCOLORATION OF POLYVINYL BUTYRAL**

Q. KIM (Caltech) and A. SHUMKA (Caltech)

Jan. 1986

**NPO-16411**

**Vol. 9, No. 3, P. 113**

Report presents results of study of discoloration in polyvinyl butyral (PVB). Clear PVB gradually turns yellowish brown in simulated-aging tests and outdoor environmental tests. Discoloration severely reduces solar-cell output. Using methods of modern analytical chemistry - transmission absorption, Fourier transform infrared absorption, atomic absorption spectroscopy, and scanning-electron microscopy - study uncovered major cause of yellowing.

**B85-10354**

### **TESTS OF ZINC RICH ANTICORROSION COATINGS**

J. D. MORRISON, W. J. PATON, and A. ROWE

Jan. 1986

**KSC-11309**

**Vol. 9, No. 3, P. 114**

Condition of zinc-rich anticorrosion coatings after 10 years of exposure discussed in status report, which follows up on 18-month study of anticorrosion coatings on steel started in 1971. Test panels with various coatings mounted on racks on beach and checked periodically. Of panels with inorganic zinc-rich coatings, only one slightly rusted. Panels were in such good condition they were returned to beach for more exposure.

**B85-10355**

### **CHARACTERIZING SEMICONDUCTOR ALLOYS FOR INFRARED SENSORS**

B. S. L. LEHOCZKY (McDonnell Douglas Research Laboratories), F. R. SZOFRAN (McDonnell Douglas Research Laboratories), and B. G. MARTIN (McDonnell Douglas Research Laboratories)

Jan. 1986

**MFS-27059**

**Vol. 9, No. 3, P. 115**

Report presents results of continuing program aimed at characterizing mercury/cadmium/tellurium alloys and eventually developing improved methods of preparing alloys for use as infrared sensors. Work covered by report includes series of differential thermal analysis (DTA) measurements of alloy compositions with x varied from 9 to 1 in 0.1 increments.

**B85-10484**

### **MEASURING RESISTIVITIES OF SMALL FIBERS**

J. DANIELS, J. M. CLEMONS, F. E. LEDBETTER, B. G. PENN, and D. J. CROUSE (Tennessee Technological University)

Mar. 1986

**MFS-28077**

**Vol. 9, No. 4, P. 100**

Technique for measuring electrical resistivities of fibers of graphite, silicon carbide/silicon nitride mixture, and other materials used in composites simple, accurate, and reproducible. Suitable for monofilament fibers with diameters of about 10 to 50 micrometers. Also adapted to two fiber strands.

**B85-10485**

### **SOLVENT-RESISTANT, THERMALLY STABLE POLY (CARBONATE-IMIDES)**

T. L. ST. CLAIR, N. T. WAKELYN, S. MAUDGAL (National Research Council), and J. R. PRATT (Mississippi University for Women)

Mar. 1986

**LAR-13292**

**Vol. 9, No. 4, P. 102**

New polymers and copolymers based on polyimide backbone with carbonate moieties exhibit high temperature capability. Because of carbonate unit, many of these materials also exhibit high order or crystallinity. All of new imidecontaining polymers insensitive to acetone. New poly (carbonate-imide) exhibits significantly increased temperature resistance and shows less sensitivity to solvents than commercial polycarbonates.

**B85-10486**

### **CHROMIUM IONS IMPROVE MOISTURE RESISTANCE OF EPOXY RESINS**

A. K. ST. CLAIR, T. L. ST. CLAIR, D. M. STOAKLEY, J. J. SINGH, and D. R. SPRINKLE

Mar. 1986

**LAR-13226**

**Vol. 9, No. 4, P. 104**

Broad spectrum of thermosetting epoxy resins used on commercial and military aircraft, primarily as composite matrices and adhesives. In new technique, chromium-ion containing epoxy with improved resistance to moisture produced where chromium ions believed to prevent absorption of water molecules by coordinating themselves to hydroxyl groups on epoxy chain. Anticipated that improved epoxy formulation useful as composite matrix resin, adhesive, or casting resin for applications on commercial and advanced aircraft. Improvement made without sacrifice in mechanical properties of polymer.

**B85-10487**

### **FAST-RESPONSE OXYGEN-MONITORING AND CONTROL SYSTEM**

J. J. SINGH, W. T. DAVIS, and R. L. PUSTER

Mar. 1986 See Also (N84-11460)

**LAR-13257**

**Vol. 9, No. 4, P. 105**

Oxygen sensor is Y2O3-stabilized ZrO2 ceramic disk maintained at 843 degrees C. Overall system response time reduced to about 0.2 second, equal to or less than 1 percent of tunnel run time. When test gas oxygen concentration differs from normal air concentration by 25 percent or more, alarm sounds, and emergency tunnel shutdown signal operates. New ZrO2 sensors intended for hypersonic-vehicle testing.

**B85-10488**  
**MEASURING THERMOELECTRIC PROPERTIES AUTOMATICALLY**

A. CHMIELEWSKI (Caltech) and C. WOOD (Caltech)

Mar. 1986

NPO-16507

Vol. 9, No. 4, P. 106

Microcomputer-controlled system speeds up measurements of Hall voltage, Seebeck coefficient, and thermal diffusivity in semiconductor compounds for thermoelectric-generator applications. With microcomputer system, large data base of these parameters gathered over wide temperature range. Microcomputer increases measurement accuracy, improves operator productivity, and reduces test time.

**B85-10489**  
**INSULATION BLANKETS FOR HIGH-TEMPERATURE USE**

H. GOLDSTEIN, D. LEISER, P. M. SAWKO, H. K. LARSON, C. ESTRELLA, M. SMITH, and F. J. PITONIAK (U.S. Air Force)

Mar. 1986

ARC-11453

Vol. 9, No. 4, P. 107

Insulating blanket resists temperatures up to 1,500 degrees F (815 degrees C). Useful where high-temperature resistance, flexibility, and ease of installation are important - for example, insulation for odd-shaped furnaces and high-temperature ducts, curtains for furnace openings and fire control, and conveyor belts in hot processes. Blanket is quilted composite consisting of two face sheets: outer one of silica, inner one of silica or other glass cloth with center filling of pure silica glass felt sewn together with silica glass threads.

**B85-10490**  
**COLORLESS, TRANSPARENT, AROMATIC POLYIMIDE FILMS**

A. K. ST. CLAIR, T. L. ST. CLAIR, K. S. EZZELL, and R. M. ELY

Mar. 1986

LAR-13351

Vol. 9, No. 4, P. 108

New process yields aromatic condensation polyimide films essentially colorless. Films between 90- and 100-percent transparent at visible wavelength of 500 nm. Optically transparent polyimide films made from variety of aromatic condensation polyimides. Range from very pale in color to colorless, compared to bright yellow color of conventional commercial aromatic polyimide film. Increased transparency achieved at no sacrifice in thermal stability, flexibility, toughness, or mechanical properties. These features extremely attractive as films or coating materials for aerospace applications or for any other applications where high optical transparency or thermal stability is required.

**B85-10491**  
**PHENOXY RESINS CONTAINING PENDENT ETHYNYL GROUPS**

P. M. HERGENROTHER

Mar. 1986 See Also (N84-16338)

LAR-13222

Vol. 9, No. 4, P. 109

Ethynyl-containing phenoxy resins have excellent shelf life in solution or in bulk. Cured ethynyl-containing phenoxy resins offer lower moisture absorption, higher use temperatures, and better thermal stability over state-of-the-art cross-linked phenoxy resins. Depending upon cross-link density, cured ethynyl-modified phenoxy resins are solvent resistant but still thermoformable and relatively tough. Modified resins show potential for use as adhesives, composite matrices, solvent-resistant coatings, membranes, insulators, and films.

**B85-10492**  
**MICRONIZED-COAL BURNER FACILITY**

F. D. CALFO and M. W. LUPTON

Mar. 1986

LEW-14131

Vol. 9, No. 4, P. 110

Micronized-coal (coal-in-oil mix) burner facility developed to fulfill need to generate erosion/corrosion data on series of superalloy specimens. In order to successfully operate gas turbine using COM, two primary conditions must be met. First, there must be adequate atomization of COM and second, minimization of coking of burner. Meeting these conditions will be achieved only by clean burning and flame stability.

**B85-10493**  
**COBALT IONS IMPROVE THE STRENGTH OF EPOXY RESINS**

D. M. STOAKLEY and A. K. ST. CLAIR

Mar. 1986 See Also (N84-13309)

LAR-13230

Vol. 9, No. 4, P. 111

Technique developed for improving mechanical strength of epoxy resins by adding cobalt ions in form of tris (acetylacetonato)cobalt (III) complex. Solid cast disks prepared from cobalt ion-containing epoxy resins tested for flexural strength and stiffness. Incorporation of cobalt ions into epoxies increased flexural strength of resins by 10 to 95 percent. Suitable resins for this technique include any liquid or solid TGMDA resins. Improved epoxy formulation proves useful as composite matrix resin, adhesive, or casting resin for applications on commercial and advanced aircraft.

**B85-10494**  
**ALKANE-BASED URETHANE POTTING COMPOUNDS**

D. E. MORRIS

Mar. 1986 See Also (N83-34047)

MFS-27047

Vol. 9, No. 4, P. 112

New low viscosity urethanes easily mixed, molded, and outgassed. Alkane-based urethanes resist hydrolysis and oxidation and have excellent dielectric properties. Low-viscosity alkane-based urethane prepolymer prepared by one-step reaction of either isophorone diisocyanate or methyl-bis (4-cyclohexyl isocyanate) with hydrogenated, hydroxy-terminated polybutadiene (HTPBD).

**B85-10495**  
**HIGH-STRENGTH, LOW-SHRINKAGE CERAMIC TILES**

W. H. WHEELER (Lockheed Missiles & Space Co., Inc.) and J. F. CREEDON (Lockheed Missiles & Space Co., Inc.)

Mar. 1986

MSC-20654

Vol. 9, No. 4, P. 113

Addition of refractory fibers and whiskers to insulating tiles composed primarily of fibrous silica, such as those used on the skin of Space Shuttle orbiter, greatly improves properties. New composition suitable for lightweight, thermally-stable mirror blanks and as furnace and kiln insulation. Improved tiles made with current tile-fabrication processes. For given density, tiles containing silicon carbide and boron additives stronger in flexure than tiles made from silica alone. In addition, tiles with additives nearly immune to heat distortion, whereas pure-silica tiles shrink and become severely distorted.

**B85-10496**  
**RESEARCH FURNACE FOR CRYSTAL PREPARATION**

R. K. CROUCH, A. L. FRIPP, JR., W. J. DEBNAM, JR., I. O. CLARK, J. M. ZWIENER (Marshall Space Flight Center), and F. M. CARLSON (Clarkson University)

Mar. 1986 See Also (N84-13211)

LAR-13302

Vol. 9, No. 4, P. 114

Three-zone furnace tested and characterized for preparation of lead-telluride (LTT) crystals. Tests show temperature in furnace controlled to obtain constant rate of movement of high-temperature isotherm down length of furnace. Temperature profiles accurately controlled by three independent heaters. Control software brings separate heaters to any desired temperature.

**B85-10497**  
**LIGHTWEIGHT PROTECTIVE GARMENTS**

E. R. DU FRESNE (Caltech)

## 04 MATERIALS

Mar. 1986

**NPO-16510**

**Vol. 9, No. 4, P. 115**

Proposed garment material protects wearer from poisonous chemicals, bacteria, and radioactive particulates. Garment allows heat, moisture, and carbon dioxide to pass from inside to outside so wearer remains comfortable. Garment made of cotton fabric on which thin layer of polyacrylate rubber is deposited by calendaring or spraying. Lighter and cooler than existing protective garments. Polyacrylate rubber selected for garment material because it transmits water vapor and carbon dioxide at high rates.

**B85-10498**

**ULTRASONIC MIXING OF EPOXY CURING AGENTS**

W. T. HODGES (U.S. Army Structures Laboratory) and T. L. ST. CLAIR

Mar. 1986 See Also (N83-27018)

**LAR-13307**

**Vol. 9, No. 4, P. 116**

New ultrasonic mixing technique used to mix several curing agents/epoxy combinations. Major component of commercially available base epoxy resin used in tetraglycidylmethylene dianiline (TGMDA). In ultrasonic mixing system cup holds resin and curing agent during acoustic excitation. Samples placed in cup with top to ultrasonic horn forming bottom of cup. Ultrasonically treated until amber colored and transparent. Because ultrasonic agitation drives out entrapped air, degassing not necessary before cure.

**B85-10499**

**ULTRA-HIGH-MOLECULAR-WEIGHT SI/PHENYLENE/SILOXANE POLYMERS**

W. J. PATTERSON, N. H. HUNDLEY, and L. M. LUDWICK

Mar. 1986 See Also (N84-19564)

**MFS-27065**

**Vol. 9, No. 4, P. 117**

Elastomers having molecular weights above 1 million made by two-stage polymerization. Two-stage process proves far more successful than synthesis from reactive monomers. Process involves synthesis of silanoterminated prepolymer and subsequent extension of prepolymer chain with additional aminosilane monomer. Multistage method allows chain-extending monomer added in precise amounts between stages.

**B85-10500**

**CAST IRON WITH HIGH CARBON CONTENT**

P. A. CURRERI, J. C. HENDRIX (University of Alabama), and D. M. STEFANESCU (University of Alabama)

Mar. 1986

**MFS-28014**

**Vol. 9, No. 4, P. 118**

Method proposed for solidifying high-carbon cast iron without carbon particles segregating at upper surface. Solidification carried out in low gravity, for example on airplane flying free-fall parabolic trajectory. Many different microstructures obtained by proposed technique, and percentage by weight of carbon retained in melt much higher than at present.

**B85-10501**

**BETA SILICON NITRIDE WHISKERS**

R. J. HOLLIDAY (John Brown University) and P. J. SHLICHTA (Caltech)

Mar. 1986

**NPO-16409**

**Vol. 9, No. 4, P. 118**

Process for growing fibrous beta silicon nitride helps meet potentially great demand for silicon nitride ceramics. Ceramics have high tensile strength and resistance to thermal shock, which make them attractive choice for high-temperature engine parts. Process forms whiskers of strong, stable, heat-resistant material. Whiskers expected to find application as reinforcement in composite silicon nitride ceramic parts. Corklike material useful in present form for thermal barrier tiles. Process forms whiskers of strong, stable, heat-resistant material.

**B85-10502**

**MECHANICAL DESIGN HANDBOOK FOR ELASTOMERS**

M. DARLOW (Mechanical Technology, Inc.) and E. ZORZI (Mechanical Technology, Inc.)

Mar. 1986 See Also (N81-26461)

**LEW-14160**

**Vol. 9, No. 4, P. 119**

Mechanical Design Handbook for Elastomers reviews state of art in elastomer-damper technology with particular emphasis on applications of highspeed rotor dampers. Self-contained reference but includes some theoretical discussion to help reader understand how and why dampers used for rotating machines. Handbook presents step-by-step procedure for design of elastomer dampers and detailed examples of actual elastomer damper applications.

**B85-10503**

**CONSTITUTIVE EQUATIONS OF AGING IN POLYMERS**

S. T. J. PENG (Caltech)

Mar. 1986

**NPO-16480**

**Vol. 9, No. 4, P. 120**

Theoretical paper presents solutions of equations that describe polymeric aging. Solutions apply under such loading conditions as constant strain (stress relaxation), constant strain rate, and stress relaxation with sudden change of cross-link density. Theoretical models form framework for predicting chemomechanical aging behavior of elastomers and polymers.

**B85-10504**

**SOLIDIFYING CAST IRON IN LOW GRAVITY**

J. C. HENDRIX, P. A. CURRERI, and D. M. STEFANESCU

Mar. 1986

**MFS-27069**

**Vol. 9, No. 4, P. 121**

Report describes study of solidification of cast iron in low and normal gravity. Because flotation, sedimentation, and convection suppressed, alloys that solidify at nearly zero gravity have unusual and potentially useful characteristics. Study conducted in airplane that repeatedly flew along parabolic trajectories. Appears iron/carbon alloys made at low gravity have greater carbon content (as high as 5 to 10 percent) than those made of Earth gravity because carbon particles do not float to top of melt.

## 05 LIFE SCIENCES

**B85-10085**

**VISION SCREENING BY COLOR PHOTOGRAPHY**

R. JAYROE, J. R. RICHARDSON, J. KERR (Electro-Optics Consultants, Inc.), S. HAY (Electro-Optics Consultants, Inc.), and R. MCBRIDE (Alabama Institute for the Deaf & Blind)

Jun. 1985

**MFS-25800**

**Vol. 9, No. 1, P. 112**

Screening test developed for detecting a range of vision defects in eye, including common precursors to amblyopia. Test noninvasive, safe, and administered easily in field by operator with no medical training. Only minimal momentary cooperation of subject required: Thus, test shows promise for use with very young children. Test produces color-slide images of retinas of eyes under specially-controlled lighting conditions. Trained observer screens five children per minute.

**B85-10086**

**COCULTURE PRODUCTION OF BUTANOL BY CLOSTRIDIUM BACTERIA**

S. L. BERGSTROM (Oklahoma State University) and G. L. FOUTCH (Oklahoma State University)

Jun. 1985

**NPO-16203**

**Vol. 9, No. 1, P. 113**

Production of butanol by anaerobic fermentation of

sugars enhanced by use of two Clostridium species, one of which feeds on metabolic product of other. Renewed interest in fermentation process for making butanol stimulated by potential use of butanol as surfactant in enhanced oil recovery. Butanol also used as fuel or as chemical feedstock and currently produced synthetically from petroleum.

**B85-10087**  
**EFFECT OF HYDRATION ON NITROGEN WASHOUT IN HUMANS**

J. WALIGORA, D. J. HERRIGAN JR., and J. CONKIN (Technology, Inc.)  
Jun. 1985 See Also NASA TM-58254(N83-26448/NSP)  
**MSC-20686** Vol. 9, No. 1, P. 113

Series of experiments described in NASA technical memorandum showed drinking water before breathing nearly pure oxygen has little or no effect on rate of removal of nitrogen from body. Experiments undertaken because data from some earlier experiments suggested that, under some conditions, hydration might help prevent decompression sickness.

**B85-10215**  
**MULTISPECTRAL ANALYSIS OF NMR IMAGERY**

R. L. BUTTERFIELD, M. W. A. A. VANNIER (Washington University School of Medicine), and D. JORDAN (University of Florida)  
Oct. 1985  
**KSC-11301** Vol. 9, No. 2, P. 106

Conference paper discusses initial efforts to adapt multispectral satellite-image analysis to nuclear magnetic resonance (NMR) scans of human body. Flexibility of these techniques makes it possible to present NMR data in variety of formats, including pseudocolor composite images of pathological internal features. Techniques do not have to be greatly modified from form in which used to produce satellite maps of such Earth features as water, rock, or foliage.

**B85-10356**  
**PROSTHETIC SPHINCTER CONTROLS URINATION**

J. B. TENNEY JR. (Rochester General Hospital)  
Jan. 1986  
**MFS-25740** Vol. 9, No. 3, P. 116

People who lost muscular control of urinary canal through disease or injury aided by prosthetic sphincter. Implanted so it surrounds urethra, sphincter deflated and inflated at will by wearer to start and stop urination. Operating pressure adjusted after implantation to accommodate growth or atrophy of urinary canal and prevent tissue damage from excess pressure. Principle adapted to other organs, such as colon, ureter, or ileum.

**B85-10357**  
**ENHANCING CENTRIFUGAL SEPARATION WITH ELECTROPHORESIS**

F. T. HERRMANN  
Jan. 1986  
**MFS-28053** Vol. 9, No. 3, P. 119

Separation of biological cells by coil-planet centrifuge enhanced by electrophoresis. By itself, coil-planet centrifuge offers relatively gentle method of separating cells under low centrifugal force in physiological medium that keeps cells alive. With addition of voltage gradient to separation column of centrifuge, separation still gentle but faster and more complete. Since separation apparatus contains no rotary seal, probability of leakage, contamination, corrosion, and short circuits reduced.

**B85-10358**  
**CAMERA FOR MONITORING VEGETATION**

T. Z. MARTIN (Caltech)  
Jan. 1986  
**NPO-16349** Vol. 9, No. 3, P. 120  
Video camera uses solid-state imaging devices and light

filters to bring out subtle spectral differences between healthy and stressed vegetation differences not readily detectable with infrared film cameras. Camera employs two detector arrays. Video camera made small and easily portable. Eliminates need for refrigeration of film before use, and provides instantaneous output with no delay for film development.

**B85-10359**  
**DEVELOPMENT OF A PROSTHESIS FOR URINARY CONTROL**

J. B. TENNEY (Rochester General Hospital), R. RABINOWITZ (Rochester General Hospital), Z. TOMKIEWICZ (Rochester General Hospital), H. N. HARRISON (Rochester General Hospital), and D. W. ROGERS (Rochester General Hospital)  
Jan. 1986  
**MFS-27062** Vol. 9, No. 3, P. 121

Report describes development and marketing of prosthetic sphincter for urinary control. With prosthetic device patients void bladder every 3 to 4 hours. Periodic voiding keeps bladder muscles exercised and healthy and avoids bladder infections and kidney damage.

**B85-10505**  
**MASS SPECTROMETER FOR AIRBORNE MICRO-ORGANISMS**

M. P. SINHA (UCLA) and S. K. FRIEDLANDER (UCLA)  
Mar. 1986  
**NPO-16359** Vol. 9, No. 4, P. 122

Bacteria and other micro-organisms identified continuously with aid of new technique for producing samples for mass spectrometer. Technique generates aerosol of organisms and feeds to spectrometer. Given species of organism produces characteristic set of peaks in mass spectrum and thereby identified. Technique useful for monitoring bacterial makeup in environmental studies and in places where cleanliness is essential, such as hospital operating rooms, breweries, and pharmaceutical plants.

**B85-10506**  
**PREADAPTING TO WEIGHTLESSNESS**

M. F. RESCHKE, D. E. PARKER (Miami University), and A. P. ARROTT (Miami University)  
Mar. 1986  
**MSC-20847** Vol. 9, No. 4, P. 124

Report discusses physiological and physical concepts of proposed training system to precondition astronauts to weightless environment. System prevents motion sickness, often experienced during early part of orbital flight. Also helps prevent seasickness and other forms of terrestrial motion sickness, often experienced during early part of orbital flight. Training affects subject's perception of inner-ear signals, visual signals, and kinesthetic motion perception. Changed perception resembles that of astronauts who spent many days in space and adapted to weightlessness.

## 06 MECHANICS

**B85-10088**  
**AIRCRAFT CANOPY LOCK**

G. H. NICHOLS  
Jun. 1985  
**FRC-11065** Vol. 9, No. 1, P. 114  
Mechanism easy to open intentionally but resists accidental opening. Locking or Unlocking occurs when pull pin enters or leaves conical base. Pushing ejection pin or

## 06 MECHANICS

pulling knob unlocks mechanism. Unintentional release unlikely since accidental pilot motions push on knob in most cases. This safety feature, coupled with simplicity and reliability of mechanism, useful for emergency exits for land vehicles or even buildings.

**B85-10089**

**INSPECTING HOLLOW PARTS WITH A CAT SCANNER**  
G. A. KUHR (Rockwell International Corp.)

Jun. 1985

**MFS-19916**

**Vol. 9, No. 1, P. 115**

Technique well known in medicine, used on manufactured objects. As it passes through a part, beam of X-rays or other radiation attenuated and scattered. Computer records variations in beam as part rotated and constructs cross section for display on video monitor. Computer-aided tomography (CAT) measures wall thickness and detecting flaws in hollow turbine blades or other curved parts.

**B85-10090**

**CONTINUOUS LAMINAR-SMOKE GENERATOR**  
L. M. WEINSTEIN

Jun. 1985

**LAR-13014**

**Vol. 9, No. 1, P. 116**

Single smoke filament used to study flow in low-speed wind tunnels. Use of small-diameter single laminar smoke stream allows examination of flow structures at higher resolution, and continuous operation facilitates use.

**B85-10091**

**INFLATABLE COLUMN STRUCTURE**

J. M. HEDGEPEETH (Astro Research Corp.)

Aug. 1985

**NPO-16216**

**Vol. 9, No. 1, P. 116**

Lightweight structural member easy to store. Billowing between circumferential loops of fiber inflated column becomes series of cells. Each fiber subjected to same tension along entire length (though tension is different in different fibers). Member is called 'isotensoid' column. Serves as jack for automobiles or structures during repairs. Also used as support for temporary bleachers or swimming pools.

**B85-10092**

**CONTACT HEAT EXCHANGER**

M. L. FLEMING (Vought Corp.), D. D. STALMACH (Vought Corp.), and R. L. COX (Vought Corp.)

Aug. 1985

**MSC-20419**

**Vol. 9, No. 1, P. 117**

Fluid pressure controls contact between heat pipe and heat exchanger. Heat exchanger system in cross section provides contact interface between fluid system and heat pipe with easy assembly/disassembly of heat-pipe/pumped-liquid system. Originally developed for use in space, new device applicable on Earth where fluid system is linked with heat pipe, where rapid assembly/disassembly required, or where high pressures or corrosive fluids used.

**B85-10093**

**MICROPROCESSOR-CONTROLLED LASER BALANCING SYSTEM**

R. S. DEMUTH (Mechanical Technology, Inc.)

Jun. 1985 See Also NASA CR-3105 (N79-17228/NSP)

**LEW-13294**

**Vol. 9, No. 1, P. 118**

Material removed by laser action as part tested for balance. Directed by microprocessor, laser fires appropriate amount of pulses in correct locations to remove necessary amount of material. Operator and microprocessor software interact through video screen and keypad; no programming skills or unprompted system-control decisions required. System provides complete and accurate balancing in single load-and-spinup cycle.

**B85-10094**

**CALIBRATING DROPLET GENERATOR FOR PRESSURIZED TESTING VESSEL**

G. J. DEFEVER (Rockwell International Corp.) and T. EXPOSITO (Rockwell International Corp.)

Jun. 1985

**MFS-25992**

**Vol. 9, No. 1, P. 119**

Device helps to align laser for droplet-sizing interferometer. Monodispersing Droplet Generator creates uniformly sized droplets. Laser source and receiver of interferometer aligned and focused on droplets. MDG mounted in high-pressure flange on tank. Line extensions pass through flange to outside. Flange allows MDG to operate at high injector back pressures used for tests.

**B85-10095**

**WINGTIP VORTEX-AUGMENTED TURBOPUSHER PROPELLER THRUST**

J. C. PATTERSON JR.

Jun. 1985 See Also NASA TN D-5729 (N70-27576/NSP)

**LAR-13019**

**Vol. 9, No. 1, P. 121**

Thrust of propeller enhanced by tip vortex. Wingtip-mounted Nacelle provides turboprop vortex velocity recovery. Thrust of turbopusher propeller increased by flow of lift-induced vortex. As result of weaker vortex, reduction in induced drag of wing afforded by propeller-wake mass injection into core of vortex causing it to break down.

**B85-10096**

**SUPERCONDUCTING-CAVITY ACCELEROMETER**

V. S. REINHARDT and F. VON BUN

Jun. 1985

**GSC-12797**

**Vol. 9, No. 1, P. 120**

Resonant frequency of microwave superconducting cavity sensitive to gravitation and acceleration. Sensitive accelerometer assembled by combining superconducting microwave cavity and conventional microwave semiconductor oscillator circuit. Device measures accelerations as small as 10-10 cm/S<sup>2</sup> (10-13 g's). Also configured to measure small gradients in gravitational field of Earth.

**B85-10097**

**REMOTELY-CONTROLLED DOCKING SYSTEM**

J. A. CHANDLER

Jun. 1985

**MSC-18969**

**Vol. 9, No. 1, P. 121**

Spring-loaded drogue cones tolerate and correct misalignment. Attachment Mechanism equipped with spring-loaded latches, shock-absorbing springs, and self-aligning conical mating surfaces. Docking system includes three attachment mechanisms plus television camera that views set of crosshairs for alignment of vehicle and payload. Originally developed for Space Shuttle, mechanism adapted for robot manipulator arms, trailer hitches, and docking devices for in-flight refueling of airplanes.

**B85-10098**

**SPRING-LOADED TRANSDUCER HOLDER**

M. R. GARDNER

Jun. 1985

**LAR-13048**

**Vol. 9, No. 1, P. 122**

Portable ultrasonic scanner moves transducer at constant pressure. Spring-loaded holder moves ultrasonic transducer over test sample at constant pressure. Setup used to determine rate of debond taking place in glued materials subjected to fatigue loading. Holder designed as portable field unit adapted to fatigue machine that transmits data while specimen tested.

**B85-10099**

**DIFFERENTIAL TEMPERATURE CONTROL OF ELECTRICAL HEATERS**

K. N. COLE

Jun. 1985

**LAR-13047**

**Vol. 9, No. 1, P. 123**

Energy savings realized from heaters that maintain low humidity in electrical equipment. Unit applies power to electrical-equipment heater only when equipment tempera-

ture drops below preset differential above ambient. With differential controller, power consumed only 118 kWh for savings of 410 kWh/day, or 77-percent energy savings.

**B85-10100**  
**DEPLOYABLE M-BRACED TRUSS**  
M. M. MIKULAS JR. and M. D. RHODES  
Jun. 1985

**LAR-13081** Vol. 9, No. 1, P. 123  
Tension/compression and shear separated structurally in deployable beam. M-Braced Sections Packaged using combination of hinges and telescoping sections. When upper sections telescope into base, diagonals hinge, telescope, and rotate along batten. Components of M-braced truss fabricated from conventional metallic materials or nonmetallic materials such as graphite/epoxy. Applications include masts for antenna feed horns and ribs for solar array blankets.

**B85-10101**  
**MULTISHAKER MODAL TESTING**  
R. R. GRAIG JR. (Bureau of Engineering Research)  
Jun. 1985

**MFS-27052** Vol. 9, No. 1, P. 124  
Report prepared for Marshall Space Flight Center summarizes recent advances in mathematical analysis of structural vibrations based on experimental data. Also includes summary of research by author as well as abstracts of technical reports and papers presented at meetings or otherwise published.

**B85-10102**  
**ROCKET-BOOSTER TOWING SIMULATION**  
T. A. TROVILLION (Planning Research Corp.)  
Jun. 1985

**KSC-11289** Vol. 9, No. 1, P. 125  
Report describes computer simulation of motion of solid-rocket ship. Listing of simulation program in FORTRAN. Mathematical techniques useful in such other maritime applications as buoy or ship design.

**B85-10216**  
**RETRACTABLE END PLATES FOR AIRCRAFT LIFTING SURFACES**  
W. D. HARVEY and S. M. MANGALAM (National Academy of Sciences)  
Oct. 1985

**LAR-12946; LAR-12947** Vol. 9, No. 2, P. 108  
End plates and winglets improve aerodynamic characteristics of aircraft wings and other fixed lifting surfaces. Retractable end plates automatically actuated by same shaft that deflects lifting surface and require little or no extra power and absolutely no control input from cockpit. Besides being modular in construction, easily fitted to any existing aircraft design with only minor modifications.

**B85-10217**  
**AERODYNAMIC REAR CONE FOR TRUCKS**  
J. BULLMAN  
Oct. 1985

**MFS-28007** Vol. 9, No. 2, P. 109  
Wind-inflated cone reduces turbulence that ordinarily occurs in air just behind square-back truck traveling at high speed. Wind around truck would enter slits in folded cone and automatically deploy it. Energy lost to air turbulence greatly reduced, and fuel consumed by truck reduced accordingly. In addition, less air turbulence means less disturbance to nearby vehicles on highway.

**B85-10218**  
**END RESTRAINTS FOR IMPACT-ENERGY-ABSORBING TUBE SPECIMENS**  
G. L. FARLEY (Structures Laboratory, U.S. Army Research and Technology Laboratories, AVSCOM) and J. T. MODLIN  
Oct. 1985

**LAR-13179** Vol. 9, No. 2, P. 109

Inexpensive device developed that eliminates tipping problem without affecting crushing process. Device consists of soft sponge-rubber insert approximately 0.5 inches (1.3 centimeters) thick, cut to same diameter as internal diameter of tube specimen. Metal washer, slightly smaller than internal diameter of tube, placed on top of rubber insert. Screw passed through washer and rubber insert and threaded into base of test machine. As screw tightened against washer, rubber insert compressed and expands radially. Radial expansion applies pressure against internal wall of tube specimen, which provides sufficient support to tube to prevent tipping.

**B85-10219**  
**ACCURATE AIRBORNE PARTICLE SAMPLER**  
I. M. MILLER  
Oct. 1985

**LAR-13080** Vol. 9, No. 2, P. 110  
Air inducted isokinetically into centrifugal collector. Cloud drop collector accurately and efficiently samples droplets and rejects aerosol particles. Number of these collectors connected in series, each designed that largest size fraction of droplets captured in first one and successively smaller size fractions captured in others. By analyzing each size fraction, chemical composition of cloud droplets related to drop size.

**B85-10220**  
**TESTING MACHINE FOR BIAXIAL LOADING**  
R. J. DEMONET (Rockwell International Corp.) and R. D. REEVES (Rockwell International Corp.)  
Oct. 1985

**MSC-20477** Vol. 9, No. 2, P. 111  
Standard tensile-testing machine applies bending and tension simultaneously. Biaxial-loading test machine created by adding two test fixtures to commercial tensile-testing machine. Bending moment applied by substrate-deformation fixture comprising yoke and anvil block. Pneumatic tension-load fixture pulls up on bracket attached to top surface of specimen. Tension and deflection measured with transducers. Modified test apparatus originally developed to load-test Space Shuttle surface-insulation tiles and particularly important for composite structures.

**B85-10221**  
**COMBINATION HEAT-FLUX AND TEMPERATURE GAGE**  
E. C. KNOX (Rockwell International Corp.)  
Oct. 1985

**MSC-20706** Vol. 9, No. 2, P. 112  
Instrument measures both temperature and temperature gradient in confined areas. With thermopile embedded in epoxy close to thermocouple, single unit measures both temperature and heat flow. Epoxy selected for low thermal conductivity and compatibility with test environment.

**B85-10222**  
**SEQUENTIALLY-DEPLOYABLE TETRAHEDRAL BEAM**  
M. M. MIKULAS JR. and R. F. CRAWFORD (General Research Corp.)  
Oct. 1985

**LAR-13098** Vol. 9, No. 2, P. 113  
Beam geometry varied three-dimensionally after beam is deployed. When tetrahedral beam completely retracted, each longeron shortened indefinitely so frames at each end of longeron folded together to lie one against other. Each tetrahedral of beam so retracted to achieve compact packaging of entire beam. Each longeron shortened by folding at midlength and ends, by telescoping, or by other means. Beam becomes crane, manipulator arm, antenna feed support, or other type of lineal structural member. Beam completely packageable, automatically deployable, and capable of having geometry varied during use.

**B85-10223**  
**HAND-HELD ELECTRONIC GAP-MEASURING TOOLS**  
F. E. SUGG (Rockwell International Corp.), F. W. THOMP-

## 06 MECHANICS

SON (Rockwell International Corp.), L. A. ARAGON (Rockwell International Corp.), and D. B. HARRINGTON (Rockwell International Corp.)

Oct. 1985

**MSC-20176**

**Vol. 9, No. 2, P. 114**

Repetitive measurements simplified by tool based on LVDT operation. With fingers in open position, Gap-measuring tool rests on digital readout instrument. With fingers inserted in gap, separation alters inductance of linear variable-differential transformer in plastic handle. Originally developed for measuring gaps between surface tiles of Space Shuttle orbiter, tool reduces measurement time from 20 minutes per tile to 2 minutes. Also reduces possibility of damage to tiles during measurement. Tool has potential applications in mass production; helps ensure proper gap dimensions in assembly of refrigerator and car doors and also used to measure dimensions of components and to verify positional accuracy of components during progressive assembly operations.

**B85-10224**

### **FIXTURE FOR LINEARLY VARIABLE DISPLACEMENT TRANSDUCERS**

G. L. FARLEY (Structures Laboratory, U.S. Army Research and Technology Laboratories, AVSCOM) and D. J. BAKER (Structures Laboratory, U.S. Army Research and Technology Laboratories, AVSCOM)

Oct. 1985

**LAR-12937**

**Vol. 9, No. 2, P. 115**

Original point of interest on shear panel tracked throughout loading. Technique and fixture measure out-of-plane displacements on shear panel using linearly variable displacement transducers (LVDT's) while tracking original panel location. Technique adaptable to any size shear panel.

**B85-10225**

### **INEXPENSIVE EDDY-CURRENT STANDARD**

R. F. BERRY JR.

Oct. 1985

**LAR-13154**

**Vol. 9, No. 2, P. 116**

Radial crack replicas serve as evaluation standards. Technique entails intimately joining two pieces of appropriate aluminum alloy stock and centering drilled hole through and along interface. Bore surface of hole presents two vertical stock interface lines 180 degrees apart. These lines serve as radial crack defect replicas during eddy-current technique setup and verification.

**B85-10226**

### **FORCE SENSOR FOR LARGE ROBOT ARMS**

A. K. BEJCZY (Caltech), H. C. PRIMUS (Caltech), and V. D. SCHEINMAN (Caltech)

Oct. 1985

**NPO-16097**

**Vol. 9, No. 2, P. 116**

Modified Maltese-cross force sensor larger and more sensitive than earlier designs. Measures inertial forces and torques exerted on large robot arms during free movement as well as those exerted by claw on manipulated objects. Large central hole of sensor allows claw drive mounted inside arm instead of perpendicular to its axis, eliminating potentially hazardous projection. Originally developed for Space Shuttle, sensor finds applications in large industrial robots.

**B85-10227**

### **TABS REDUCE HELICOPTER-BLADE VIBRATIONS**

T. G. CAMPBELL (United Technologies Corp.)

Oct. 1985

**ARC-11444**

**Vol. 9, No. 2, P. 117**

Tuned flaplike tab on trailing edge of helicopter rotor blade reduces blade vibration. Flapping tab on rotor blade produces aerodynamic loads that oppose vibrational aerodynamic loads. With proper choice of tab parameters, tab made to cancel much of blade vibration over wide range of rotor speeds and airspeeds.

**B85-10228**

### **FLOWMETER FOR CLEAR AND TRANSLUCENT FLUIDS**

P. R. WHITE

Oct. 1985

**MFS-20030**

**Vol. 9, No. 2, P. 117**

Transducer with only three moving parts senses flow of clear or translucent fluid. Displacement of diaphragm by force of flow detected electrooptically and displayed by panel meter or other device. Transducer used to measure flow of gasoline to automobile engine.

**B85-10229**

### **LOW-TEMPERATURE SEAL FOR ACTUATOR ROD**

R. J. LINDFORS (Consolidated Controls Corp.)

Oct. 1985

**MSC-20744**

**Vol. 9, No. 2, P. 118**

Combination bearing and seal used on Space Shuttle functions reliably at temperatures as low as -160 degrees F and as high as +130 degrees F. Corrosion-resistant stainless-steel spacer separates secondary and primary seals in both old and new versions of seal assembly. In new version, combination of flexible sealing lip and bridge is less susceptible to cracking at low temperatures.

**B85-10230**

### **DETECTING CRACKS IN ROUGH METAL SURFACES**

N. T. ZUVER (Rockwell International Corp.), F. E. SUGG (Rockwell International Corp.), F. H. STUCKENBERG (Rockwell International Corp.), and E. T. MORRISSEY (Rockwell International Corp.)

Oct. 1985

**MSC-20734**

**Vol. 9, No. 2, P. 119**

Test based on eddy-current probe technique identifies cracks in swaged metals. Hinged collar with spring-loaded latch holds probe in place on part tested. For repeated measurements on same or similar parts, collar loosened and moved to various measuring positions. Method suitable for many kinds of metal parts, including swaged fittings, tubing, and pipes. Used for rapid crack/no-crack determinations in suspect parts already installed.

**B85-10231**

### **STATISTICAL ENERGY ANALYSIS PROGRAM**

R. C. FEREBEE (McDonnell Douglas Astronautics Co.), R. W. TRUDELL (McDonnell Douglas Astronautics Co.), L. I. YANO (McDonnell Douglas Astronautics Co.), and S. I. NYGAARD (McDonnell Douglas Astronautics Co.)

Oct. 1985

**MFS-27035**

**Vol. 9, No. 2, P. 120**

Statistical Energy Analysis (SEA) is powerful tool for estimating high-frequency vibration spectra of complex structural systems and incorporated into computer program. Basic SEA analysis procedure divided into three steps: Idealization, parameter generation, and problem solution. SEA computer program written in FORTRAN V for batch execution.

**B85-10232**

### **ANALYSES OF MULTISHAFT ROTOR-BEARING RESPONSE**

H. D. NELSON (Arizona State University) and W. L. MEACHAM (Arizona State University)

Oct. 1985

**LEW-13925**

**Vol. 9, No. 2, P. 127**

Method works for linear and nonlinear systems. Finite-element-based computer program developed to analyze free and forced response of multishaft rotor-bearing systems. Acronym, ARDS, denotes Analysis of Rotor Dynamic Systems. Systems with nonlinear interconnection or support bearings or both analyzed by numerically integrating reduced set of coupled system equations. Linear systems analyzed in closed form for steady excitations and treated as equivalent to nonlinear systems for transient excitation. ARDS is FORTRAN program developed on an Amdahl 470 (similar to IBM 370).

**B85-10360****ADHESIVE-BONDED FIXTURE FOR FLEXURE TESTING**  
J. M. CLEMONS, B. G. PENN, F. E. LEDBETTER, J. G. DANIELS, and W. T. WHITE

Jan. 1986

**MFS-28051****Vol. 9, No. 3, P. 122**

Fixture for flexural tests of glass-fiber-reinforced epoxy rods 1/4 in. (6.4 mm) in diameter easy to fabricate. Little machining done by relatively unskilled. Flexural-test fixture allows bending stress applied to specimen rod while holding rod securely. Dowel pins, blocks, and plate that make up fixture joined by adhesive.

**B85-10361****DAMAGE-FREE RELIEF-VALVE DISASSEMBLY**  
H. HASELMAIER (Pan Am World Services, Inc.)

Jan. 1986

**MFS-28006****Vol. 9, No. 3, P. 123**

Tool safely disassembles relief valves without damage to sensitive parts. Relief-valve disassembly tool used to extract valve nozzle from its housing. Holding device on tool grips nozzle. When user strikes hammer against impact disk, holding device pulls nozzle from press fit. Previously, nozzle dislodged by striking spindle above it, but practice often damaged retaining screw. New tool removes nozzle directly. With minor modifications, tool adapted to valves from different manufacturers.

**B85-10362****DEPLOYABLE TRUSS MEMBER**

N. T. FRINK

Jan. 1986

**LAR-13219****Vol. 9, No. 3, P. 124**

Compact telescoping roll extends 24 times its length. Roll telescopes into extended truss member when force is applied. Truss members deployed by various means. Truss member initially constructed in its stowed state with appropriate sheet material rolled around central core. For deployment truss extends by centrifugal force to form cone. With both ends fastened to prevent unrolling, rigid truss member formed.

**B85-10363****ELEVATED-TEMPERATURE TENSILE-TESTING OF FOIL-GAGE METALS**

L. B. BLACKBURN and J. R. ELLINGSWORTH

Jan. 1986

**LAR-13243****Vol. 9, No. 3, P. 125**

Automated system for measuring strain in metal foils at temperatures above 500 degrees F (260 degrees C) uses mechanical extensometer and displacement transducer. System includes counterbalance feature, which eliminates weight contribution of extensometer and reduces grip pressure required for attachment to specimen. Counterbalancing feature overcomes two major difficulties in using extensometers with foil-gage specimens: (1) Weight of extensometer and transducer represents significant fraction of total load applied to specimen and may actually damage it; and (2) grip pressure required for attachment of extensometer to specimens may induce bending stresses in foil-gage materials.

**B85-10364****AUTOPILOT SERVOACTUATOR WITH PRESSURIZED DETENTED CENTERING**

J. A. ARING (The Boeing Co.)

Jan. 1986

**LAR-13185****Vol. 9, No. 3, P. 126**

Centering valve allows use of mechanical override in autopilot mode. Alternate system designed incorporates centering valves into four FBW servos, providing detents for reacting mechanical system forces following FBW shutdown. Required linkage hard point incorporated directly into autopilot servoactuator by centering valve assembly shown. All components in this functional hydraulic schematic usually present in contemporary aircraft flight-control-

system autopilot servoactuators, with exception of centering valve. Centering valve, which serves as hard-point linkage for mechanical system forces, incorporated directly into flight control system.

**B85-10365****MEASURING PERIMETERS OF LARGE ROUND OBJECTS**  
C. B. DICKINSON (Martin Marietta Corp.)

Jan. 1986

**MFS-28046****Vol. 9, No. 3, P. 127**

Perimeters of large objects of approximately circular cross section determined indirectly through radius measurements by any of several proposed methods. Methods reduce errors introduced by wheel moved around perimeter and counting wheel turns: Surface irregularities and variations in friction and contact pressure seriously affect accuracy and repeatability of wheel measurements. Measurement concept applicable to such other large bodies as aircraft fuselages and generator rotors.

**B85-10366****LIQUID-LEVEL MONITOR FOR PRESSURIZED VESSELS**  
J. J. SINGH, W. T. DAVIS, and G. H. MALL (Computer Sciences Corp.)

Jan. 1986 See Also (N83-33844)

**LAR-13208****Vol. 9, No. 3, P. 128**

Technique for monitoring water levels in pressurized stainless-steel cylinders, based on differences in gamma-ray attenuation coefficients in water and air, developed. Full-scale laboratory prototype system constructed to test technique. Technique usable with liquids other than water, since linear attenuation coefficients for intermediate-energy gamma rays in air considerably lower than in liquids. Also adaptable for continuous monitoring of liquid levels in reservoir systems and in underground storage tanks.

**B85-10367****MEASURING METAL THICKNESS WITH AN ELECTRIC PROBE**

A. SHUMKA (Caltech)

Jan. 1986

**NPO-16340****Vol. 9, No. 3, P. 129**

Thickness of metal parts measured from one side with aid of Kelvin probe. Method developed for measuring thickness of end plate on sealed metal bellows from outside. Suitable for thicknesses of few thousandths of inch (few hundred micrometers). Method also used to determine thickness of metal coatings applied by sputtering, electroplating, and flame spraying.

**B85-10368****LOW-NOISE SUPERSONIC NOZZLE**

I. E. BECKWITH

Jan. 1986

**LAR-13192****Vol. 9, No. 3, P. 130**

Two-dimensional nozzle incorporates unusual design features of rapid expansion contour, boundary-layer bleed slots upstream of throat, and exit width-to-height ratio of 1.7 to provide noise levels in upstream regions of test rhombus substantially lower than in conventional nozzles.

**B85-10369****TOGGLE HINGE FOR DEPLOYABLE STRUTS**

R. T. BARBOUR (Rockwell International Corp.)

Jan. 1986

**MFS-28037****Vol. 9, No. 3, P. 131**

Toggle hinge allows deployable structures erected without end play encountered in conventional hinged structural members. New hinge ensures rigidity in portable bridges, masts, towers, platforms, and other deployable (and retractable) structures. Positioned halfway along length of folding strut, hinge allows halves of strut to pivot 180 degrees about center.

**B85-10370****FRICTION-TESTING MACHINE**

## 06 MECHANICS

F. J. BENZ, D. S. DIXON, and R. C. SHAW (Lockheed Corp.)

Jan. 1986

MSC-20622

Vol. 9, No. 3, P. 132

Testing machine evaluates wear and ignition characteristics of materials in rubbing contact. Offers advantages over other laboratory methods of measuring wear because it simulates operating conditions under which material will actually be used. Machine used to determine wear characteristics, rank and select materials for service with such active oxidizers as oxygen, halogens, and oxides of nitrogen, measure wear characteristics, and determine coefficients of friction.

B85-10371

NONINVASIVE FLUID LEVEL SENSOR FOR ORGANO-METALLIC SOURCES

W. GERDES

Jan. 1986

LAR-13265

Vol. 9, No. 3, P. 133

Two ultrasonic methods available for measuring level of organometallic liquid in stainless-steel (or other homogeneous solid) container. Methods require no disassembly or weighing of container. Commercially available ultrasonic flaw detectors, some of which have digital readouts and computer interfaces, used in techniques. Both methods used in crystal growth to determine level of liquids contained in sealed, opaque containers.

B85-10372

FLOWMETER FOR CLEAR FLUIDS

P. R. WHITE and W. R. MCINTOSH

Jan. 1986

MFS-28031

Vol. 9, No. 3, P. 134

Electronic flowmeter measures flow rate of clear or translucent fluids. Instrument produces electrical signal proportional to volume of fluid flowing through it per unit time. Optoelectronic instrument generates electrical signal proportional to fluid-flow rate.

B85-10373

TILTABLE-WING, TILTABLE-ROTOR AIRCRAFT

R. H. STROUB

Jan. 1986

ARC-11420

Vol. 9, No. 3, P. 135

New airplane wing tilts 90 degrees, leading edge up, to feather into rotor downwash during hovering, takeoff, or landing. After hovering or takeoff, rotors tilted forward slightly to accelerate airplane into forward flight. As airplane accelerates, wings start to tilt forward. At speeds of 20 to 40 knots (10.3 to 20.6 m/s), wings are in horizontal orientation. In this speed range, rotor power requirements decreased sufficiently to allow wings to assume normal orientation. Tiltable wings movable independently of tiltable rotors. Tilted at whatever pitch schedule yields greatest efficiency.

B85-10374

NONCONTACTING MEASUREMENT WITH A THERMO-COUPLE

W. T. WEATHERILL (Rockwell International Corp.), C. J. SCHOREDER (Rockwell International Corp.), and H. J. FREITAG (Rockwell International Corp.)

Jan. 1986

MSC-20834

Vol. 9, No. 3, P. 136

Tentlike covering brings thermocouple to within few degrees of surface temperature. Technique originally developed for measuring surface temperature of quartz fabric under radiant heating requires no direct contact with heated surface. Technique particularly useful when measuring surface temperatures of materials damaged if thermocouple or other temperature sensor attached.

B85-10375

TETHERED COMMUNICATION SATELLITES

G. VON TIESENHAUSEN

Jan. 1986

MFS-28042

Vol. 9, No. 3, P. 136

Report describes concept for placing several communication satellites in geostationary orbit without taking up more space than assigned to single satellite. Proposed scheme eases orbital crowding more economically than space platforms. Concept requires minimal redesign of existing satellites and accommodates many satellites in just one orbital slot. System much lighter in weight than geostationary platform and easier and more economical to transport.

B85-10376

PREDICTING TWO-DIMENSIONAL, UNSTEADY TURBULENT COMBUSTION

C. J. MAREK, A. F. GHONIEM (University of California), and A. K. OPPENHEIM (University of California)

Jan. 1986

LEW-14027

Vol. 9, No. 3, P. 137

MIMOC calculates flow field and flame propagation in turbulent combustion tunnel. Program employs algorithm for turbulent combustion modeling described by Ghoniem, Chorin, and Oppenheim. Program used to study flow field in model combustor, formed by rearward-facing step in channel, in terms of vorticity field, velocity field, turbulent shear stresses, flame contours, and concentration field.

B85-10377

AIRFOIL SMOOTHING AND SCALING PROGRAMS

H. L. MORGAN JR

Jan. 1986

LAR-13132

Vol. 9, No. 3, P. 137

Two programs smooth and scale arbitrary airfoil coordinates. Airfoil smoothing program (AFSMO) utilizes both least-squares polynomial and least-squares cubic-spline techniques to smooth iteratively second derivatives of y-axis airfoil coordinates with respect to transformed x-axis system that unwraps airfoil and stretches nose and trailing-edge regions.

B85-10378

THERMAL, ONE-DIMENSIONAL ANALYZER PROGRAM

D. K. PATEL (Rockwell International Corp.) and D. P. JONES (Rockwell International Corp.)

Jan. 1986

MSC-20703

Vol. 9, No. 3, P. 137

Thermal, one-dimensional analyzer program enables user to predict surface temperature of fibrous, feltlike insulation exposed to some external radiant heat source or convective heating produced by aerodynamic forces. Prediction derived from readings of thermocouple embedded in material at some depth below surface. Program useful in analysis and evaluation of insulative qualities of similar or new compositions.

B85-10379

NASTRAN/DISCOS/SAMSON DMAP BRIDGING PROGRAM

H. P. FRISCH

Jan. 1986

GSC-12902

Vol. 9, No. 3, P. 138

Design of controller for flexible structure must incorporate flexible body data in format compatible with design and performance evaluation methods. Control designer works with several different programs to obtain all data and capabilities needed. Three programs for design and analysis of flexible structure controllers integrated.

B85-10380

INELASTIC ANALYSIS OF THERMOMECHANICALLY CYCLED STRUCTURES

A. KAUFMAN

Jan. 1986

LEW-14011

Vol. 9, No. 3, P. 138

Simplified inelastic analysis computer program (ANSYMP) developed for predicting stress/strain history of

thermomechanically cycled structure from an elastic solution. Program uses an iterative and incremental procedure to estimate plastic strains from material stress/strain properties and simulated plasticity hardening model. Program ANSYMP developed to simplify nonlinear structural analysis using only elastic solution as input data.

**B95-10381**  
**GEOMETRIC AND MATERIAL NONLINEAR STRUCTURAL ANALYSIS**

J. D. WHITCOMB and B. DATAGURU

Jan. 1986

**LAR-13279** Vol. 9, No. 3, P. 139

GAMNAS (Geometric and Material Nonlinear Analysis of Structures) is twodimensional finite-element stress-analysis program supporting fracture-mechanics studies of debonding and delamination. GAMNAS options include linear, geometric-nonlinear, material-nonlinear, and combined geometric- and material-nonlinear analysis.

**B85-10382**  
**ANALYSIS OF SCRAMJET INLETS**

A. KUMAR

Jan. 1986

**LAR-13297** Vol. 9, No. 3, P. 139

NASCRIAN analyzes two-dimensional flow fields in supersonic combustion ramjet (scramjet) inlets. Solves two-dimensional Euler or Navier-Stokes equations in conservative form by unsplit, explicit, two-step finite-difference method. More recent explicit/implicit, two-step scheme also incorporated for viscous flow analysis. Algebraic, two-layer eddy-viscosity model used for turbulent flow calculations.

**B85-10507**  
**LATCH FOR TELESCOPING STRUCTURES**

E. L. AHL JR.

Mar. 1986

**LAR-13189** Vol. 9, No. 4, P. 126

Latch for three-member telescoping column developed for deployment of antenna 122 meters in diameter. Deployable column along axis of antenna open lattice structure with three longerons as principal loadbearing members. Column divided into telescoping sections that deploy, one section at time. Latch automatically locks sections into position during deployment and unlocks them when antenna restowed. Latch is four-bar linkage using over-center principle for locking, with Belleville spring washers to absorb deflections.

**B85-10508**  
**WATER-THICKNESS GAGE**

L. M. WEINSTEIN

Mar. 1986 See Also (N84-27677)

**LAR-13342** Vol. 9, No. 4, P. 127

Gage for determining depth of water buildup on outside of aircraft relatively simple to operate and yields result independent of conductivity of water. Gage used to evaluate effects of water on lift and detect water weight excesses. Dual-sensor gage eliminates effects of water conductivity, providing direct correlation between resistivity and water thickness.

**B85-10509**  
**ROTARY SPEED SENSOR FOR ANTILOCKING BRAKES**

C. M. BERDAHL (Caltech)

Mar. 1986

**NPO-16479** Vol. 9, No. 4, P. 128

Sensor based on fluidic principles produces negative pressure approximately proportional to rotational speed. Sensor developed as part of antilocking brake system for motorcycles. Uses inlet pressure rather than outlet pressure as braking-control signal, eliminating pressure pulsations caused by pump vanes and ensuring low-noise signal. Sensor is centrifugal air pump turned by one of motorcycle

wheels. Air enters pump through orifice plates, and suction taken off through port in pump inlet plenum.

**B85-10510**  
**CALCULATING BEARING FORCES FROM STRAIN-GAGE SIGNALS**

J. R. FENWICK (Rockwell International Corp.)

Mar. 1986

**MFS-29000** Vol. 9, No. 4, P. 129

Technique for obtaining force components on cylindrical bearing holder uses pairs of opposing strain gages. Signals proportional to outputs of pairs of opposing gages subtracted from each other. Subtraction nearly eliminates crosstalk between orthogonal force components. Signal-processing technique equally applicable to rotating as well as stationary loads.

**B85-10511**  
**PHOTO-OPTICAL BLADE-VIBRATION-DATA ACQUISITION SYSTEM**

L. J. KIRALY and J. L. FRAREY (Mechanical Technology, Inc.)

Mar. 1986 See Also (N80-14113)

**LEW-12887** Vol. 9, No. 4, P. 130

Techniques developed for measuring blade vibrations using optical sensors fixed in casing around bladed turbine-engine stage. Measurement system coordinates and assembles inputs of many optical probes in order to monitor all of blades on spinning stage. Several points on every blade monitored in order to develop quantitative measure of overall bladed-stage response.

**B85-10512**  
**LOCKING PULL PIN**

T. O. KILLGROVE (Caltech)

Mar. 1986

**NPO-16233** Vol. 9, No. 4, P. 131

Proposed self-locking pull pin not accidentally released by shock or vibration but intentionally released by pull on lanyard. Any rotational movement of main pin traps secondary pin: prevents further rotation and disengagement of main pin.

**B85-10513**  
**DISTRIBUTING RADIANT HEAT IN INSULATION TESTS**

H. J. FREITAG (Rockwell International Corp.), A. R. REYES (Rockwell International Corp.), and M. C. AMMERMAN (Rockwell International Corp.)

Mar. 1986

**MSC-20878** Vol. 9, No. 4, P. 131

Thermally radiating blanket of stepped thickness distributes heat over insulation sample during thermal vacuum testing. Woven of silicon carbide fibers, blanket spreads heat from quartz lamps evenly over insulation sample. Because of fewer blanket layers toward periphery of sample, more heat initially penetrates there for more uniform heat distribution.

**B85-10514**  
**SMOOTHED TWO-DIMENSIONAL EDGES FOR LAMINAR FLOW**

B. J. HOLMES, C. H. LIU, G. L. MARTIN (Kentron International, Inc.), C. S. DOMACK (Kentron International, Inc.), C. J. OBARA (Kentron International, Inc.), A. HASSAN (Arizona State University), M. D. GUNZBURGER (Carnegie-Mellon University), and R. A. NICOLAIDES (Carnegie-Mellon University)

Mar. 1986

**LAR-13255** Vol. 9, No. 4, P. 132

New concept allows passive method for installing flaps, slats, ice-protection equipment, and other leading-edge devices on natural-laminar-flow (NFL) wings without causing loss of laminar flow. Two-dimensional roughness elements in laminar boundary layers strategically shaped to increase critical (allowable) height of roughness. Facilitates installa-

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tion of leading-edge devices by practical manufacturing methods.

**B85-10515**

### FUEL GAGE FOR SLOSHING TANKS

H. D. GARNER and W. E. HOWELL

Mar. 1986

**LAR-13147**

**Vol. 9, No. 4, P. 133**

New gage accurately measures fuel remaining in moving, or sloshing, tank. Measures tank air (or other gas) pressure and time required for pressure to change from one pre-selected level to another. Time measurement directly proportional to volume of air. Data processor computes relative volumes of air and fuel in tank.

**B85-10516**

### CALIBRATING PRESSURE TRANSDUCERS AT CRYOGENIC TEMPERATURES

B. V. GIBBENS

Mar. 1986 See Alos (N84-11458)

**LAR-13242**

**Vol. 9, No. 4, P. 134**

To calibrate transducers immersed in cryogenic environment, sealed reciprocating bellows generates sinusoidal dynamic pressure. Transducer manifold assembly and bellows immersed in cryogenic environment to minimize gradients in controllable cryogenic temperature.

**B85-10517**

### BRAILLE READING SYSTEMS

H. D. GARNER

Mar. 1986

**LAR-13306**

**Vol. 9, No. 4, P. 135**

Two proposed electromechanical systems for making braille characters produced relatively inexpensively. Similar in operating principle to dotmatrix printers, two methods use electronically actuated pins to reproduce characters from information stored on magnetic tape. First, one or more pins scanned over blank page and energized at intervals to emboss text on paper, one or more dots at time. Second, handheld device containing one or more character-generator cells used by reader to scan lines of text manually.

**B85-10518**

### HYDRAULIC CYLINDER WITH AN INTEGRAL POSITION INDICATOR

G. O. GOODWIN (Kentron International, Inc.)

Mar. 1986

**LAR-13095**

**Vol. 9, No. 4, P. 136**

Linear variable differential transformer (LVDT) incorporated within cylinder of hydraulic actuator gives precise readout of position of piston relative to cylinder. LVDT contained completely within actuator. System requires precise positioning and position readout for computer control of model motions. Minimal space available for motion cylinders, and precise, continuous position readout (with no steps or pulses) required. Device provides continuous and accurate position indication of a hydraulic cylinder by means of integral, coaxially mounted LVDT.

**B85-10519**

### SHAFT AXIAL-DISPLACEMENT SENSOR

A. J. HILL (Rockwell International Corp.)

Mar. 1986

**MFS-29048**

**Vol. 9, No. 4, P. 137**

Shaft-speed sensor on turbopump readily adapted to indicate shaft axial displacement as well as rotational speed. Adaptation makes it unnecessary to install separate displacement sensor, which requires additional access port on pump. Combined speed/displacement sensor used for performance analysis and for pump control.

**B85-10520**

### ACCELERATED STRESS-CORROSION TESTING

(Innovator Not Given)(Aluminum Company of America) Mar. 1986 See Also (N85-11218 and N85-11219)

**LAR-13337**

**Vol. 9, No. 4, P. 137**

Test procedures for accelerated stress-corrosion testing of high-strength aluminum alloys faster and provide more quantitative information than traditional pass/fail tests. Method uses data from tests on specimen sets exposed to corrosive environment at several levels of applied static tensile stress for selected exposure times then subsequently tensile tested to failure. Method potentially applicable to other degrading phenomena (such as fatigue, corrosion fatigue, fretting, wear, and creep) that promote development and growth of cracklike flaws within material.

**B85-10521**

### MINIATURE MICROPHONE ADAPTER

J. C. MANNING and J. W. SIMPSON

Mar. 1986

**LAR-13210**

**Vol. 9, No. 4, P. 138**

New microphone adapter permits installation of commercially available condenser microphone 1/8 inch (3 mm) in diameter at location of sensing ports, with remotely located preamplifier. Microphone has high-impedance source and low-level electrical output signal; therefore, adapter designed with minimum capacitance to avoid degradation of microphone sensitivity. Probe insensitive to aeroacoustic disturbances in high-velocity flow.

**B85-10522**

### ELECTRONIC/HYDRAULIC LEVEL GAGE

B. HANNINEN (Martin Marietta Corp.) and D. HARTLEY (Martin Marietta Corp.)

Mar. 1986

**MFS-28066**

**Vol. 9, No. 4, P. 139**

System for checking levelness of machines and structures requires less time and labor than conventional optical systems. Measures differences in elevation to within 0.002 in. (0.05 mm). Floats at opposite ends of structure determine positions of cores in linear variable-differential transformers. Outputs of LVDT's carried by cables to control console, where displayed to operator as difference in core levels and therefore of ends of structure.

**B85-10523**

### ADVANCED VAPOR-SUPPLY MANIFOLD

I. O. CLARK, W. J. DEBNAM JR., A. L. FRIPP JR., and R. K. CROUCH

Mar. 1986

**LAR-13259**

**Vol. 9, No. 4, P. 140**

Advanced vapor-supply manifold solves problem of manifold purging. Design virtually eliminates dead gas volumes in manifold system. System incorporates special valve into manifold in way that leaks and contamination problems of previous systems, which use tees and three-port valves, are minimized or eliminated in both main manifold line and in supply line. Of considerable use in gas manifold systems where even small amounts of gaseous impurities constitute problem or where more than one gaseous material used in single system.

**B85-10524**

### TITANIUM HEAT-PIPE WICKS

R. SHAUBACH (Thermacore, Inc.), G. Y. EASTMAN (Thermacore, Inc.), and D. M. ERNST (Thermacore, Inc.)

Mar. 1986

**MFS-26016**

**Vol. 9, No. 4, P. 141**

Sintered titanium offers several advantages over sintered aluminum as material for heat-pipe wicks. Titanium both strong and light. Thermal conductivity only one-seventh of aluminum, and therefore used when high thermal resistance is needed to prevent boiling of working fluid.

**B85-10525**

### MICROPHONE BOOM FOR AIRCRAFT-ENGINE MONITORING

R. COHN, M. ECONOMU, and W. ALBRECHT

Mar. 1986

**ARC-11495**

**Vol. 9, No. 4, P. 141**

Microphone for measuring aircraft engine noise mounted on lengthwise boom supported away from fuselage and engine. This configuration minimizes boundary-layer effects and pressure doubling that is present if microphone were mounted in aircraft fuselage.

**B85-10526**  
**THERMAL-DIODE SANDWICH PANEL**  
A. BASIULIS (Hughes Aircraft Co.)  
Mar. 1986  
**LAR-13121**

**Vol. 9, No. 4, P. 142**  
Thermal diode sandwich panel transfers heat in one direction, but when heat load reversed, switches off and acts as thermal insulator. Proposed to control temperature in spacecraft and in supersonic missiles to protect internal electronics. In combination with conventional heat pipes, used in solar panels and other heat-sensitive systems.

**B85-10527**  
**REDUCTION OF VANE NOISE IN WIND-TUNNEL NOZZLES**  
R. M. MARTIN, T. F. BROOKS, and D. R. HOAD (U.S. Army Structures Laboratory)  
Mar. 1986  
**LAR-13333**

**Vol. 9, No. 4, P. 143**  
Vane-induced noise reduced by adhering thin layer of porous material such as foam to downwind surface of vanes, particularly near sharp trailing edges, to prevent occurrence of edge tones. Other modifications made to aerodynamically streamline vane structure were rounding leading edges and smoothly fairing trailing edges. Boundary layer trip applied to leading edge to prevent laminar tone shedding from trailing edge.

**B85-10528**  
**SQUEEZE-FILM DAMPER CONTROLS HIGH VIBRATIONS**  
D. P. FLEMING  
Mar. 1986  
**LEW-13506**

**Vol. 9, No. 4, P. 144**  
Dual-clearance (two oil films) squeeze-film damper developed for controlling vibrations in aircraft turbine engines and other rotating machinery. New damper under normal conditions uses only one low-clearance film. Under high imbalance, both films active, controlling shaft vibration in nearoptimum manner and allowing continued operation until safe shutdown made.

**B85-10529**  
**NOISE-PATH MEASUREMENTS IN AIRCRAFT STRUCTURES**  
M. C. MCGARY and W. H. MAYES  
Mar. 1986 See Also (N83-11838)  
**LAR-13017**

**Vol. 9, No. 4, P. 145**  
System determines amount of radiated sound power separately attributed to airborne and structure-borne paths in aircraft. Also used to evaluate vibrating plates and thin shells. Sound transducers include array of lightweight, miniature piezoelectric accelerometers and two-microphone probe. Multichannel Fast Fourier Transform (FFT) analyzer/computer used for analog-to-digital conversion and to analyze spectrum of each of input signals. Noise-path identification in aircraft performed in flight by this system.

**B85-10530**  
**STIFFNESS STUDY OF WOUND-FILAMENT PRESSURE VESSELS**  
V. VERDERAIME  
Mar. 1986 See Also (N84-33521)  
**MFS-27086**

**Vol. 9, No. 4, P. 145**  
Report presents theoretical and experimental study of stiffness of lightweight, jointed pressure vessels made of wound graphite fibers and epoxy. Specimens fabricated from layers of graphite fibers, wet with epoxy, on aluminum mandrel. Segment ends thickened with interspersed layers of axially oriented fibers to reduce pinhole bearing stresses and local deformations. Segments cured at 390 degrees F

(199 degrees C). Report presents results of vibrational tests of one-quarter-scale models of wound-filament pressure vessels.

**B85-10531**  
**PREDICTING THE PERFORMANCE OF AN AXIAL-FLOW COMPRESSOR**  
R. J. STEINKE  
Mar. 1986  
**LEW-14025**

**Vol. 9, No. 4, P. 146**  
Stage-stacking computer code (STGSTK) developed for predicting off-design performance of multi-stage axial-flow compressors. Code uses meanline stagestacking method. Stage and cumulative compressor performance calculated from representative meanline velocity diagrams located at rotor inlet and outlet meanline radii. Numerous options available within code. Code developed so user modify correlations to suit their needs.

**B85-10532**  
**AXIAL-FLOW COMPRESSOR PERFORMANCE WITH WATER INGESTION**  
T. TSUCHIYA (Purdue University) and S. B. MURTHY (Purdue University)  
Mar. 1986  
**LEW-14026**

**Vol. 9, No. 4, P. 147**  
Stage-stacking computer code (WISGSK) developed for prediction of offdesign axial-flow compressor performance with water ingestion. Code uses meantime stage-stacking method; stage and cumulative compressor performance calculated utilizing representative triangles located at rotor inlet and outlet mean radii. Code provides options for calculation of performance with mixtures of gases such as air and water vapor and air/water droplet mixtures with different water contents. Useful for obtaining preliminary estimates of overall performance of compressors with water ingestion given design point details corresponding to airflow and nature of corrections for air/water mixture flow.

**B85-10533**  
**FLOW THROUGH GAS-TURBINE DUCTS**  
O. L. ANDERSON (United Technologies Corp.), G. B. HANKINS JR. (United Technologies Corp.), and D. E. EDWARDS (United Technologies Corp.)  
Mar. 1986  
**LEW-14095**

**Vol. 9, No. 4, P. 147**  
Existing computer program, Axisymmetric Diffuser Duct code (ADD code), modified to permit calculation of flows through small gas-turbine ducts with struts, guide vanes, and large degrees of turning. Code improvements include new coordinate generator, endwall loss model, and generalized geometry capability to describe struts and guide vanes in ducts that turn more than 90 degrees. Improved output format developed to provide solution on any arbitrary plane in duct.

**B85-10534**  
**AUTOMATED DESIGN SYNTHESIS**  
G. N. VANDERPLAATS (Naval Postgraduate School)  
Mar. 1986  
**LAR-13341**

**Vol. 9, No. 4, P. 147**  
Automated Design Synthesis (ADS) program is general-purpose numerical optimization program containing wide variety of algorithms. Assumed user prepares analysis problem capable of computing objective function and constraints. Program able to accept as part of input design variable quantities. Optimization process carried out by ADS coupled with user's program. ADS used for constrained and unconstrained function minimization. Solution of general problem separated into three basic levels: Strategy, Optimizer, and One-Dimensional Search. Already significant applications in area of structural synthesis (minimum-weight design).

**B85-10535**  
**RADIATION VIEW-FACTOR PROGRAM WITH INTERAC-**

## 06 MECHANICS

### TIVE GRAPHICS

A. F. EMERY (University of Washington)  
Mar. 1986

LAR-13299

Vol. 9, No. 4, P. 148

VIEW is six computer programs for determining view factors, graphically displaying surfaces, and evaluating solar irradiation of assemblage of surfaces. Programs offer thermal engineer powerful system for view-factor determination. Central program of system (VIEWC) computes long-wave radiant energy exchange factors between surfaces that make up enclosure. Other VIEW programs support user working with VIEWC.

B85-10536

### FOUR-CYLINDER STIRLING ENGINE CONTROL SIMULATION

C. J. DANIELE and C. F. LORENZO

Mar. 1986

LEW-14106

Vol. 9, No. 4, P. 148

Four-cylinder, Stirling-engine, transient-engine-simulation computer program developed. Program intended for control analysis. Associated engine model simplified to shorten computer calculation time. Model includes engine mechanical-drive dynamics and vehicle-load effects. Computer program also includes subroutines that allow acceleration of engine by addition of hydrogen to system and braking of engine by short circuiting of working spaces.

B85-10537

### SOLUTION OF RADIATION AND CONVECTION HEAT-TRANSFER PROBLEMS

R. F. ONEILL (General Dynamics Corp.)

Mar. 1986

LEW-13978

Vol. 9, No. 4, P. 149

Computer program P5399B developed to accommodate variety of fin-type heat conduction applications involving radiative or convective boundary conditions with additionally imposed local heat flux. Program also accommodates significant variety of one-dimensional heat-transfer problems not corresponding specifically to fin-type applications. Program easily accommodates all but few specialized one-dimensional heat-transfer analyses as well as many two-dimensional analyses.

B85-10538

### ORBIT TRANSFER PROGRAMS

J. V. BREAKWELL (Stanford University)

Mar. 1986

LEW-14089

Vol. 9, No. 4, P. 150

Collection of computer programs developed that solve problem of transfer between noncoplanar circular orbits for spacecraft with chemical propulsion systems. Two basic programs given. First, referred to as 'exact solution,' gives complete, exact time histories of transfers. Second, or 'approximate solution,' program gives approximate information on transfer time and fuel cost but provides no detail of trajectory.

B85-10539

### BEARING THERMAL PERFORMANCE PREDICTION

R. J. PARKER

Mar. 1986 See Also (N84-18654)

LEW-14163

Vol. 9, No. 4, P. 150

Parameter called lubricant percent volume or cavity factor (XCAV) used primarily in calculation of ball or roller drag and, therefore, significantly affects calculated bearing-heat generation and temperature distribution. New equation accounts for sensitivity of XCAV to shaft speed, lubricant flow rate, and bearing size, and provides significant improvement over previous estimation methods.

B85-10540

### THREE-DIMENSIONAL, SUBSONIC, TURBULENT JUNCTION REGION FLOW

A. J. BAKER (Computational Mechanics Consultants), P. D. MANHARDT (Computational Mechanics Consultants),

and J. A. ORZECOWSKI (Computational Mechanics Consultants)  
Mar. 1986

LAR-13263

Vol. 9, No. 4, P. 150

CMC3DPNS predicts three-dimensional, subsonic, turbulent aerodynamic juncture region flow. Versatile program for comprehensive flow-field analysis applies finite-element methodology to nonlinear field problems. Order-of-magnitude analysis of subsonic, three-dimensional, steady time-averaged Navier-Stokes equations for semibounded aerodynamic juncture geometries yields parabolic Navier-Stokes equations. CMC3DPNS solves these equations to predict juncture-region flow.

B85-10541

### ZERO-LIFT WAVE DRAG OF COMPLEX AIRCRAFT CONFIGURATIONS

C. B. CRAIDON

Mar. 1986

LAR-13223

Vol. 9, No. 4, P. 150

WAVDRAG calculates supersonic zero-lift wave drag of complex aircraft configurations. Numerical model of aircraft used throughout design process from concept to manufacturing. Incorporates extended geometric input capabilities to permit use of more accurate mathematical model. Engineer defines aircraft components as fusiform or nonfusiform in terms of traditional parallel contours or nonintersecting contours in any direction. Laterally asymmetric configurations simulated. WAVDRAG calculates total drag and wave-drag coefficient of specified aircraft configuration.

## 07 MACHINERY

B85-10103

### SIMULATING PRESSURE EFFECTS OF HIGH-FLOW VOLUMES

M. KAUFMAN (Rockwell International Corp.)

Jun. 1985

MFS-19909

Vol. 9, No. 1, P. 126

Dynamic test stresses realized without high-volume pumps. Assembled in Sections in gas-flow passage, contoured mandrel restricts flow rate to valve convenient for testing and spatially varies pressure on passage walls to simulate operating-pressure profile. Realistic test pressures thereby achieved without extremely high flow volumes.

B85-10104

### LOW-LOSS FUEL AND OXIDIZER INJECTOR

G. L. PRAGEMAU

Jun. 1985

MFS-25989

Vol. 9, No. 1, P. 127

Pressure losses reduced without degrading combustion stability. Injection Posts form forest in cavity between oxygen manifold and secondary faceplate. Cavity is fuel manifold; fuel floods post forest and enters each post through side holes in shroud. Injector designed for improved assembly and maintenance. Posts accessible from primary combustion chamber side and changed for flow adjustment.

B85-10105

### CONTINUOUSLY VARIABLE TRANSMISSION

D. C. GRANA

Jun. 1985

LAR-12844

Vol. 9, No. 1, P. 128

Chain slides along two cones, in novel transmission concept. Transmission includes chain drive between two splined shafts. Chain sprockets follow surfaces of two cones.

As one chain sprocket moves toward smaller diameter other chain sprocket moves toward larger diameter, thereby changing 'gear' ratio. Movement initiated by tension applied to chain by planetary gear mechanism. Device positive, simple, and efficient over wide range of speed ratios.

B85-10106

**SPILL-DETECTOR-AND-SHUTOFF DEVICE**

M. R. JARVIS (University of Illinois) and D. S. FULTON (University of Illinois)

Jun. 1985  
MSC-20206

Vol. 9, No. 1, P. 129

Overflow in liquid chromatography systems rapidly detected and stopped. Spill-detector-and-shutoff device incorporated into liquid-chromatography system. When liquid from output nozzle spills on liquid sensor, device automatically shuts off pump and releases solenoid to pinch off flow in tube. Device uses common type of alarm circuit reset manually before normal operation resumes.

B85-10107

**RECIPROCATING MAGNETIC REFRIGERATOR**

D. L. JOHNSON (CALTECH)

Jun. 1985  
NPO-16257

Vol. 9, No. 1, P. 130

Unit cools to 4 K by adiabatic demagnetization. Two porous matrices of paramagnetic material gadolinium/gallium/garnet held in long piston called displacer, machined out of Micarta (phenol formaldehyde polymer). Holes in side of displacer allow heat-exchange fluid to flow to and through matrices within. Piston seals on displacer prevent substantial mixing of fluid in two loops. Magnetic refrigerator provides continuous rather than 'one-shot' cooling.

B85-10108

**FLUSHING RING FOR EDM**

L. EARWOOD (Rockwell International Corp.)

Jun. 1985  
MFS-19876

Vol. 9, No. 1, P. 131

Removing debris more quickly lowers cutting time. Operation, cutting oil and pressurized air supplied to ring placed around workpiece. Air forces oil through small holes and agitates oil as it flows over workpiece. High flow rate and agitation dislodge and remove debris. Electrical discharge removes material from workpiece faster.

B85-10109

**BACK-PRESSURE REGULATOR FOR LARGE GAS FLOWS**

E. A. THEODORE (Rockwell International Corp.) and F. CHIN (Rockwell International Corp.)

Jun. 1985  
MSC-20536

Vol. 9, No. 1, P. 131

Cost reduced, and safety enhanced. Pipe exit partially obstructed by conical throat plug. When pressure in pipe falls below (or rises above) desired back pressure, plug automatically moved in (or out). Applications of system lie in environmental testing or production facilities requiring large gas flows at low pressures.

B85-10110

**AIR BEARING FOR SMALL PLANAR VIBRATIONS**

M. F. WOLF (Stanford University)

Jun. 1985  
MFS-26003

Vol. 9, No. 1, P. 132

Air-cushion device provides vibrations along axes 90 degrees apart. Bearing includes movable slide sandwiched between two fixed support plates. Separation between plates adjusted to standard air-bearing tolerances. Pressurized air supplied to slide so it floats between plates on cushion of air. Air exhausts on top and bottom surfaces of three arms of slide. Developed for stirring crystal-growth liquids in containers.

B85-10111

**QUASI-POROUS PLUG WITH VORTEX CHAMBER**

J. V. WALSH (CALTECH)

Jun. 1985  
NPO-16076

Vol. 9, No. 1, P. 133

Pressure-letdown valve combines quasi-porous-plug and vortex-chamber in one controllable unit. Valve useful in fossil-energy plants for reducing pressures in such erosive two-phase process streams as steam/water, coal slurries, or combustion gases with entrained particles. Quasi-Porous Plug consists of plenums separated by perforated plates. Number or size of perforations increases with each succeeding stage to compensate for expansion. In Vortex Chamber, control flow varies to control swirl and therefore difference between inlet and outlet pressures.

B85-10112

**HINGED-BLADE, VERTICAL-SHAFT WINDMILL**

B. SHULTZ JR.

Jun. 1985  
MFS-25980

Vol. 9, No. 1, P. 134

Vertical-shaft windmill concept calls for hinged, flapping blades to increase energy-conversion efficiency by reducing wind-energy loss. Hinged Blade Halves unfold to catch wind when moving with it, then fold away from wind when moving against it.

B85-10113

**FASTENING PARTS HAVING MISMATCHED THERMAL COEFFICIENTS**

L. R. JACKSON, R. C. DAVIS, A. H. TAYLOR, R. R. MCWITHEY, and M. L. BLOSSER

Jun. 1985  
LAR-13009

Vol. 9, No. 1, P. 137

Fastener eliminates thermal stresses and maintains snug fit. Conical-head bolt and metal washer main components of fastener that keeps constant tension on carbon/carbon parts regardless of thermal stress. Fastener used in cases where fastened parts have unmatched thermal-expansion coefficients. Does not become looser or tighter as conventional bolts and nuts or rivets do at elevated temperatures.

B85-10114

**PERFORMANCE IMPROVEMENT FOR NONAXISYMMETRIC NOZZLES**

B. L. BERRIER

Jun. 1985  
LAR-13036

Vol. 9, No. 1, P. 138

Internal flow separation eliminated during reverse thrust. Convergent and Divergent Nozzle Flaps rotate to form reverser blocker for reverse-thrust operation. During cruise operation, drums rotate in direction of external flow. During reverse-thrust operation, drums rotate in direction of internal flow. Rotating-drum thrust reverser and boundary-layer control device improves performance of nonaxisymmetric nozzles in three ways: (1) Controls thrust-reverser exhaust port area by elimination of internal flow separation in reverser exhaust port; (2) provides control of reverse-thrust flow direction (exhaust angle); and (3) eliminates external flow separation over nozzle boattail.

B85-10115

**AUTOMATIC ERECTION SYSTEM FOR ANTENNA MASTS**

R. D. DOTSON (Lockheed Missiles & Space Co.) and G. G. JACQUEMIN (Lockheed Missiles & Space Co.)

Jun. 1985  
LAR-13115

Vol. 9, No. 1, P. 139

A telescoping mast does not require the payout of guy wires under tension. Erection system is built into stack of telescoping mast elements and is thereby protected from the weather. Concept is based on a telescoping tube mast, it is also applicable to an open truss with only minor modifications.

B85-10116

**LONG-LIFE CRYOGENIC COOLER**

A. SHERMAN, M. G. GASSER, P. STUDER, A. DANIELS (North American Philips Corp.), and M. GOLDOWSKY (North

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- American Philips Corp.)  
Jun. 1985  
**GSC-12697** Vol. 9, No. 1, P. 140  
Magnetic bearings and noncontacting seals let cooler operate unattended at 65 K for more than 3 years. New cooler uses magnetic bearings, small piston/cylinder clearance seals, and linear motors. Cooler consists of compression and expansion sections connected end-to-end. Compression section houses reciprocating hollow piston driven by linear motor.
- B85-10117**  
**MECHANICAL MIXER FOR RUDDER/BRAKING WEDGE**  
D. GRIMM (Sundstrand Energy Systems)  
Jun. 1985  
**MSC-20759** Vol. 9, No. 1, P. 141  
Right and left rudder panels moved separately. Mechanical mixer enables panels of two-panel rudder to rotate in same direction for steering or in opposite directions for dynamic braking. Steering and braking inputs separate so any combination of steering and braking motions executed simultaneously. Developed for aerodynamic braking of Space Shuttle orbiter, steering/braking drive train and rudder arrangement used for similar purposes on aircraft, thereby reducing sizes of thrust reversers.
- B85-10118**  
**WIDE-GRASP LATCHING MECHANISM**  
M. F. NESMITH  
Jun. 1985  
**MFS-28002** Vol. 9, No. 1, P. 141  
Fingers capture and clamp without accurate positioning. Fully open position, fingers encompass large envelope. When activated by rack and pinion, fingertips move together, thereby grasping object within envelope.
- B85-10119**  
**CUTTHROUGH WARNING CIRCUIT**  
R. MCKOWN (Rockwell International Corp.)  
Jun. 1985  
**MFS-19900** Vol. 9, No. 1, P. 142  
Damage to underlying layer averted. Contact of cutter blade with metal shim completes circuit that warns cutting-tool operator to stop. Tool thus prevented from cutting into structural wall.
- B85-10120**  
**REMOTELY PILOTED AIRCRAFT FOR RESEARCH**  
T. W. REZEK  
Jun. 1985 See Also NASA TM-84913 (N83-27978/NSP)  
**ARC-11498** Vol. 9, No. 1, P. 143  
NASA Technical Memorandum presents overview of remotely-piloted research vehicle (RPRV) activities. Controlled from ground, vehicles allow new concepts tried without subjecting pilots to danger. Critical role of pilot in flight testing with RPRV's demonstrated repeatedly, and many system anomalies uncovered with no risk to human life.
- B85-10121**  
**SENSITIVITIES OF SOAP SOLUTIONS IN LEAK DETECTION**  
D. STUCK (Rockwell International Corp.), D. Q. LAM (Rockwell International Corp.), and C. DANIELS (Rockwell International Corp.)  
Jun. 1985  
**MFS-19864** Vol. 9, No. 1, P. 143  
Document describes method for determining minimum leak rate to which soap-solution leak detectors sensitive. Bubbles formed at smaller leak rates than previously assumed. In addition to presenting test results, document discusses effects of joint-flange configurations, properties of soap solutions, and correlation of test results with earlier data.
- B85-10233**  
**AUTOMATED COAL-MINING SYSTEM**  
M. D. GANGAL (Caltech), L. ISENBERG (Caltech), and E. V. LEWIS (Caltech)  
Oct. 1985  
**NPO-16177** Vol. 9, No. 2, P. 128  
Proposed system offers safety and large return on investment. System, operating by year 2000, employs machines and processes based on proven principles. According to concept, line of parallel machines, connected in groups of four to service modules, attacks face of coal seam. High-pressure water jets and central auger on each machine break face. Jaws scoop up coal chunks, and auger grinds them and forces fragments into slurry-transport system. Slurry pumped through pipeline to point of use. Concept for highly automated coal-mining system increases productivity, makes mining safer, and protects health of mine workers.
- B85-10234**  
**POINTABLE AUGER**  
E. V. LEWIS (Caltech)  
Oct. 1985  
**NPO-16178** Vol. 9, No. 2, P. 129  
Machine drills, crushes, and feeds coal - and seeks out extra-hard inclusions. Auger mounted on gimbal, located at its center of gravity for ease of maneuvering. Opposing hydraulic cylinders cooperate to point auger under control of microprocessor. Its diamond teeth break up coal seam, it crushes coal fed to it by mining machine jaws, and its screw action pushes crushed coal into slurry-forming chamber.
- B85-10235**  
**MODULAR PICK-AND-BUCKET MINING MACHINE**  
M. D. GANGAL (Caltech) and E. V. LEWIS (Caltech)  
Oct. 1985  
**NPO-16179** Vol. 9, No. 2, P. 130  
Concept for improved conventional pick-and-bucket mining machine offered as backup for hydrojet-jaw mining machine. Picks on chain dislodge coal and buckets on chain scoop it up. Depending on width cut, unit composed of only two end modules or end modules plus one, two, or three incremental modules. Folding curved shields protect sides of miner from falling coal and rock. Two side stabilizers - extendable hydraulic members anchor miner against lateral drift. Unlike conventional machines, new version tilts cutters vertically and skews them horizontally to changing floor slopes and seam heights.
- B85-10236**  
**REDUCING COAL DUST WITH WATER JETS**  
M. D. GANGAL (Caltech) and E. V. LEWIS (Caltech)  
Oct. 1985  
**NPO-16180** Vol. 9, No. 2, P. 131  
Jets also cool and clean cutting equipment. Modular pick-and-bucket miner suffers from disadvantage: Creates large quantities of potentially explosive coal dust. Dust clogs drive chain and other parts and must be removed by hand. Picks and bucket lips become overheated by friction and be resharpened or replaced frequently. Addition of oscillating and rotating water jets to pick-and-bucket machine keeps down dust, cools cutting edges, and flushes machine. Rotating jets wash dust away from drive chain. Oscillating jets cool cutting surfaces. Both types of jet wet airborne coal dust; it precipitates.
- B85-10237**  
**SLURRY-MIXING CHAMBER**  
E. V. LEWIS (Caltech)  
Oct. 1985  
**NPO-16182** Vol. 9, No. 2, P. 132  
Paddles and water jets create uniform, continuous flow. Slurry-mixing chamber on hydrojet-jaw mining machine ensures uniform, continuously flowing slurry of coal particles in water. By mixing coal and water at high speed and keeping resulting slurry in constant motion, chamber prevents slurry from becoming dry semisolid that blocks

flow. Also prevents coal particles from settling and caking in bends, corners, and other locations where flow changes in direction or speed.

**B85-10238**  
**ALL-WATER-JET COAL EXCAVATOR**  
M. D. GANGAL (Caltech)

Oct. 1985  
NPO-16183

Vol. 9, No. 2, P. 133

Version of jaw miner operates without mechanical cutting and crushing. Forward-pointing jets of water dislodge and break up coal. Rearward-pointing jets further break up coal and force particles into slurry chamber. Oscillating-jet mechanism itself stays within 'jaw' structure and protected from wear and tear associated with coal handling. All-jet machine generates even less dust than anger, therefore poses lesser explosion or health hazard.

**B85-10239**  
**COAL-SIZING AUGER**  
E. V. LEWIS (Caltech)

Oct. 1985  
NPO-16184

Vol. 9, No. 2, P. 134

Aft end of auger, like forward, face-piercing end, equipped with hard cutting bits such as diamonds. As auger breaks face, pulls broken coal lumps into jaws and forces them into hardened throat section. There, cutting bits chew up lumps: Clearance between throat and auger shaft sets maximum size for coal particles that pass through. Auger motion pushes coal particles into mixing chamber, where paddles combine them with water.

**B85-10240**  
**SERVICE MODULES FOR COAL EXTRACTION**  
M. D. GANGAL (Caltech) and E. V. LEWIS (Caltech)

Oct. 1985  
NPO-16185

Vol. 9, No. 2, P. 134

Service train follows group of mining machines, paying out utility lines as machines progress into coal face. Service train for four mining machines removes gases and coal and provides water and electricity. Flexible, coiling armored carriers protect cables and hoses. High coal production attained by arraying row of machines across face, working side by side.

**B85-10241**  
**SIDE SHIELD FOR WALL SUPPORT**  
E. V. LEWIS (Caltech)

Oct. 1985  
NPO-16188

Vol. 9, No. 2, P. 135

Method employs curved shield on each side of mining machine. In stowed position, shield folded against roof-support columns on one side. In deployed position, shield raised and braced against coal-seam wall by hydraulic cylinder. Shield supports wall until roof and wall properly secured by bolting and cement coating.

**B85-10242**  
**ROOF SHIELD FOR ADVANCE AND RETREAT MINING**  
E. V. LEWIS (Caltech)

Oct. 1985  
NPO-16189

Vol. 9, No. 2, P. 136

Shield sections change their configuration to suit mining mode. Articulation cylinders raise rear shield to advance position, and locking cylinders hold it there. To change to retreat position articulation cylinders lower shield. Locking pins at edge of outermost shield latch shield to chock base. Shield accommodates roof heights ranging from 36 to 60 inches (0.9 to 1.52 meters).

**B85-10243**  
**COMPACT HYDRAULIC EXCAVATOR AND SUPPORT UNIT**  
E. V. LEWIS (Caltech)

Oct. 1985  
NPO-16190

Vol. 9, No. 2, P. 136

Continuous-coal-mining machine maneuverable. Hydraulic coal excavator combined with chock, or roof-support structure, in self-contained unit that moves itself forward as it removes coal from seam. Unlike previous such units, new machine compact enough to be easily maneuverable; even makes small-radius right-angle turns.

**B85-10244**  
**CURTAIN WALL CREATES VENTILATION CHANNEL**  
E. V. LEWIS (Caltech)

Oct. 1985  
NPO-16194

Vol. 9, No. 2, P. 137

Curtain-wall structure proposed for removing methane and airborne coal dust from hydrojet-jaw mining machines. Channel between curtain wall and mine wall forms closed exhaust passage. Through it, gas and dust continuously removed so high concentrations of these explosive materials not build up.

**B85-10245**  
**HOLDER FOR ULTRASONIC EVALUATION OF SMALL-DIAMETER TUBES**  
E. C. TAYLOR

Oct. 1985  
LAR-13152

Vol. 9, No. 2, P. 138

Simple holder eliminates requirement for expensive turntable. Holder works by rotating cylindrical specimens about y-axis. Rotation synchronized with movement of transducer to permit testing without use of turntable. Holder attached to crossmember of scanning bridge with C-clamp. Permits testing of small-diameter tubes rapidly, accurately, and economically. Designed for use with commercially available electromechanical drum-type ultrasonic immersion testing device used for nondestructive evaluation of variety of materials.

**B85-10246**  
**IMPROVED HIGHWAY PADS FOR TRACKED VEHICLES**  
E. R. COLLINS JR. (Caltech)

Oct. 1985  
NPO-16318

Vol. 9, No. 2, P. 138

New pads attach faster and hold more securely than conventional pads. Rubber pad held on tread by bent locking tab and by lip that engages recess in tread. Tab hammered in during installation and pried out during removal. New designs ease installation of rubber pads on treads of tracked vehicles to prevent damage to highways. Designs apply to bulldozers, cranes, and excavating machines.

**B85-10247**  
**LOW-FRICTION JOINT FOR ROBOT FINGERS**  
C. F. RUOFF (Caltech)

Oct. 1985  
NPO-15914

Vol. 9, No. 2, P. 140

Mechanical linkage allows adjacent parts to move relative to each other with low friction and with no chatter, slipping, or backlash. Low-friction joint of two surfaces in rolling contact, held in alignment by taut flexible bands. No sliding friction or 'stick-slip' motion: Only rolling-contact and bending friction within bands. Proposed linkage intended for finger joints in mechanical hands for robots and manipulators.

**B85-10248**  
**BLIND-SIDE, HIGH-TEMPERATURE FASTENER LOCK**  
E. C. MATZA (Vought Corp.) and D. M. WHILE (Vought Corp.)

Oct. 1985  
LAR-13037

Vol. 9, No. 2, P. 140

Formed-in-place staple provides positive mechanical lock. Post-supported, advanced carbon/carbon standoff panels, currently under consideration as alternate thermal protection system for Shuttle orbiter, locking feature applicable to temperatures of 1,600 degrees F (870 degrees C) and higher and employable after panel installed, resulting in blind application. Blind-side locking technique employs

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wire staple inserted into grooves in post, formed in place by ramped portion of post grooves. This splays out wire ends that move into castellated end of grommet, mechanically locking post and grommet against relative rotation. Splayed ends provide mechanical lock to prevent wire from falling out.

**B85-10249**

### INSULATING CRYOGENIC PIPES WITH FROST

J. G. STEPHENSON (Rockwell International Corp.) and J. A. BOVA (Rockwell International Corp.)

Oct. 1985

MSC-20426

Vol. 9, No. 2, P. 141

Crystallized water vapor fills voids in pipe insulation. Small, carefully controlled amount of water vapor introduced into dry nitrogen gas before it enters aft fuselage. Vapor freezes on pipes, filling cracks in insulation. Ice prevents gaseous nitrogen from condensing on pipes and dripping on structure, in addition to helping to insulate all parts. Industrial applications include large refrigeration plants or facilities that use cryogenic liquids.

**B85-10250**

### PRECISE ELECTROCHEMICAL DRILLING OF REPEATED DEEP HOLES

J. P. KINCHELOE (Rockwell International Corp.)

Oct. 1985

MFS-19767

Vol. 9, No. 2, P. 142

Tooling enables maintenance of close tolerances. Tooling includes guide that holds electrochemical drilling electrodes in proper relative alignment and guide-positioning fixture clamps directly on reference surfaces of strut. High precision achieved by positioning tooling anew on each strut before drilling: Tolerances of (0.008 mm) maintained in some details.

**B85-10251**

### ADAPTER HELPS TO ALINE PLASMA TORCH

C. A. BROSEMER (Denver Aerospace)

Oct. 1985

MFS-28024

Vol. 9, No. 2, P. 143

Simple adapter allows plasma welding torch aligned accurately on weld seam. Adapter fits over nozzle of torch. Light from pilot arc inside torch passes through central orifice in cone. Light emerges from cone as beam that creates spot of light at point where torch impinges on workpiece. When torch is aligned with work, adapter is removed, plasma arc struck, and welding proceeds.

**B85-10252**

### THERMAL SHOCK-RESISTANT COMPOSITE CRUCIBLE

H. J. GERINGER and R. W. JECK

Oct. 1985

LEW-14105

Vol. 9, No. 2, P. 143

Heating rates of 350 degrees F per minute have not caused cracking. Surrounding inner crucible is annulus of loosely packed alumina powder, which serves as compressible insulating material. Second annulus consisting of section of fused-quartz tubing surrounds and retains alumina powder. Quartz tube held in place by refractory cement helps to contain alumina powder. Small holes in upper ring of cement allow alumina powder to outgas during operation in vacuum. Originally intended for use in Chill Block Melt Spinning (CBMS) apparatus, crucible adaptable to other operations involving rapid self-induction heating of metallic charges.

**B85-10253**

### MINIATURE ROCKET MOTOR FOR AIRCRAFT STALL/SPIN RECOVERY

M. H. LUCY

Oct. 1985

LAR-13199

Vol. 9, No. 2, P. 144

Design accommodates different thrust levels and burn times with minimum weight. Different thrust levels achieved by substituting other propellants of different diameter and

burn-rate characteristics. Different burn times achieved by simply changing length of grain/tube assembly. Grain bond material also acts as insulator for fiberglass tube. Rocket motor attached to aircraft model and ignited from radio-controlled 4.8-volt power source. Device provides more than twice energy available in previous designs at only 60 percent of weight. Rocket motor used to identify energy requirements for aircraft stall/spin recovery positive propulsion system.

**B85-10254**

### SHAFT SEAL COMPENSATES FOR COLD FLOW

W. N. MYERS and L. A. HEIN

Oct. 1985

MFS-25678

Vol. 9, No. 2, P. 145

Seal components easy to install. Ring seal for rotating or reciprocating shafts spring-loaded to compensate for slow yielding (cold flow) of sealing material. New seal relatively easy to install because components preassembled, then installed in one piece.

**B85-10255**

### IMPROVED EXHAUST DIFFUSER FOR JET-ENGINE TESTING

P. G. PARIKH (Caltech) and V. S. SAROHA (Caltech)

Oct. 1985

NPO-16328

Vol. 9, No. 2, P. 146

High-altitude simulator reduced power requirements. Test cell uses its exhaust-capture duct only to remove gases from engine; cooling air evacuated through separate path by auxiliary suction system. This way, capture duct cross-sectional area kept close to exhaust jet area, leading to greatly improved recovery performance.

**B85-10256**

### GRADUALLY ACTING SHAFT STOP

D. J. LANG (Sundstrand Energy Systems)

Oct. 1985

MSC-20729

Vol. 9, No. 2, P. 147

Mechanism brakes rotation with minimal shock. Balls rising on spiral ramp generate large axial force on brake friction plates, thereby generating large braking torque. Counter triggers rise of ball. Brake used to automatically stop control mechanisms on aircraft and ships. Serves as spindle brake on machine tool. On robot, prevents overtravel of arm or holds it in fixed position.

**B85-10257**

### HAND-HELD POWER CLAMP

J. P. CLANCY (McDonnell Douglas Corp.)

Oct. 1985

MSC-20549

Vol. 9, No. 2, P. 147

Tool furnishes large pushing or pulling forces. Device includes two clamping blocks, two clamping plates, and a motor-driven linear actuator with selflocking screw shaft. Power clamp exerts opening or closing force at push of switch. Tool approximately 1 m long. Originally designed to secure payload aboard Space Shuttle, operated with one hand to apply opening or closing force of up to 1,000 lb (4,400 N). Clamp has potential applications as end effector for industrial robots and in rescue work to push or pull wreckage with great force.

**B85-10258**

### ANVIL FOR FLARING PCB GUIDE PINS

E. WINN (Sperry Flight Systems Corp.) and R. TURNER (Sperry Flight Systems Corp.)

Oct. 1985

MSC-20345

Vol. 9, No. 2, P. 148

Spring-loaded anvil results in fewer fractured pins. New anvil for flaring guide pins in printed-circuit boards absorbs approximately 80 percent of press force. As result fewer pins damaged, and work output of flaring press greatly increased.

**B85-10259**  
**EFFECTS OF BEARING CLEARANCE ON TURBOPUMP STABILITY**

(Innovator Not Given) (Control Dynamics Co.) Oct. 1985 See Also N84-19814  
**MFS-27063**

**Vol. 9, No. 2, P. 148**

Effects of bearing clearances, or 'dead bands,' on bearing loads and rotor stability in turbopumps examined in a 194-page report. Relatively simple mathematical force model for analyzing effects highlighted. Report shows nonlinear characteristics resulting from bearing dead bands have significant effect on dynamics of turbomachinery and not ignored as in the past.

**B85-10260**  
**OPTIMIZING LOAD SPECTRA FOR GEARS**

S. P. P. OYOUNG (Sundstrand Energy Systems) and W. L. CARSON (University of Missouri)  
 Oct. 1985

**MSC-20487**

**Vol. 9, No. 2, P. 149**

Life expectancy of gear systems extended. NASA document presents algorithm for gear-load-spectrum synthesis (GLSS) as aid in choosing best load spectrum for machine containing gears. Objective of GLSS: Determine best schedule or combination of load elements-one that yields longest possible fatigue life for machine.

**B85-10261**  
**PREDICTING LEAKAGE IN LABYRINTH SEALS**

G. L. MORRISON (Texas A & M University), D. L. RHODE (Texas A & M University), K. C. COGAN (Texas A & M University), D. CHI (Texas A & M University), and J. DEMKO (Texas A & M University)  
 Oct. 1985

**MFS-27051**

**Vol. 9, No. 2, P. 149**

Analytical and empirical methods evaluated. 264-page report presents comprehensive information on leakage in labyrinth seals. Summarizes previous analyses of leakage, reviews leakage tests conducted by authors and evaluates various analytical and experimental methods of determining leakage and discusses leakage prediction techniques.

**B85-10262**  
**EXPERIMENTS WITH A MANIPULATOR SENSOR SYSTEM**

A. K. BEJCZY (Caltech), R. S. DOTSON (Caltech), J. W. BROWN (Johnson Space Center), and J. L. LEWIS (Johnson Space Center)  
 Oct. 1985

**NPO-16094**

**Vol. 9, No. 2, P. 149**

Force and torque data aid operator. Report describes experiments with system that displays data on forces and torques acting on end effector of remote manipulator. Demonstrated usefulness of display in manipulation tasks with narrow geometric and dynamic tolerances. Such tasks encountered in manufacturing and in operations requiring use of tools.

**B85-10263**  
**HYBRID AND ELECTRIC ADVANCED VEHICLE SYSTEMS SIMULATION**

R. F. BEACH, R. A. HAMMOND (Boeing Computer Services Co.), and R. K. MCGEHEE (Boeing Computer Services Co.)  
 Oct. 1985

**LEW-13927**

**Vol. 9, No. 2, P. 150**

Predefined components connected to represent wide variety of propulsion systems. Hybrid and Electric Advanced Vehicle System (HEAVY) computer program is flexible tool for evaluating performance and cost of electric and hybrid vehicle propulsion systems. Allows designer to quickly, conveniently, and economically predict performance of proposed drive train.

**B85-10264**  
**AUTOMATICALLY-PROGRAMMED MACHINE TOOLS**

L. PURVES and N. CLERMAN (Computer Sciences Corp.)

Oct. 1985  
**GSC-12758**

**Vol. 9, No. 2, P. 151**

Software produces cutter location files for numerically-controlled machine tools. APT, acronym for Automatically Programmed Tools, is among most widely used software systems for computerized machine tools. APT developed for explicit purpose of providing effective software system for programing NC machine tools. APT system includes specification of APT programing language and language processor, which executes APT statements and generates NC machine-tool motions specified by APT statements.

**B85-10265**  
**ANALYSIS OF SPIRAL BEVEL GEARING**

R. J. DRAGO (Boeing Vertol Co.) and B. R. UPPALURI (Boeing Vertol Co.)  
 Oct. 1985

**LEW-14067**

**Vol. 9, No. 2, P. 151**

Program generalized for automated finite-element-method model generation. Tedious task of finite-element-method (FEM) model preparation greatly reduced by development of preprocessing program for automated model generation. Utility of program, including ability to rapidly evaluate parametric changes, demonstrated for spiral, helical, and spiral bevel gearing. Postprocessing program also developed, aids in review and interpretation of calculated FEM stresses.

**B85-10383**  
**CONSTANT-PRESSURE SAWING**

G. M. ORRIS (Solarex Corp.) and J. F. GERRETY (Solarex Corp.)  
 Jan. 1986

**NPO-15233**

**Vol. 9, No. 3, P. 140**

Attachment for reciprocating power-saw maintains nearly constant cutting pressure even though kerf length varies. Attachment developed for wire saws used to slice cylindrical silicon ingots into wafers for semiconductor devices. By maintaining constant pressure, attachment helps to ensure smooth, flat, uniform wafers. Principle adaptable to straight, toothed saws as well as to wire saws.

**B85-10384**  
**ROTATING CONNECTION FOR ELECTRICAL CABLES**

D. R. MANGES

Jan. 1986

**GSC-12899**

**Vol. 9, No. 3, P. 141**

Cable reel provides electrical connections between fixed structure and rotating one. Reel carries power and signal lines while allowing rotating structure to turn up to 360 degrees with respect to fixed structure. Reel replaces sliprings. Can be used to electrically connect arm of robot with body. Reel releases cable to rotating part as it turns and takes up cable as rotating part comes back to its starting position, without tangling, twisting, or kinking.

**B85-10385**  
**MORE SECURE FASTENING FOR TRACKED-VEHICLE PADS**

E. R. COLLINS JR. (Caltech)

Jan. 1986

**NPO-16321**

**Vol. 9, No. 3, P. 142**

Method of fastening road pads on tracked vehicles ensures retaining tabs properly installed and less likely to fail from shock or pad squirring when tracked vehicle turns. No risk squirring of pad might overcome retaining force of rubber encapsulation or teeth of split-collet fastener shred soft-iron projections on pad shell, causing inadvertent release of pad. Rod extending through track shells and tabs on pad shells includes grooved cams to secure pads.

**B85-10386**  
**COMPACT HYBRID AUTOMOTIVE PROPULSION SYSTEM**

G. LUPO (Centro Recherche Fiat S.p.A.)

Jan. 1986

## 07 MACHINERY

- NPO-16117** **Vol. 9, No. 3, P. 143**  
Power train proposed for experimental vehicle powered by internal combustion engine and electric motor. Intended for front-wheel drive automobile, power train mass produced using existing technology. System includes internal-combustion engine, electric motor, continuously variable transmission, torque converter, differential, and control and adjustment systems for electric motor and transmission. Continuously variable transmission integrated into hydraulic system that also handles power steering and power brakes. Batteries for electric motor mounted elsewhere in vehicle.
- B85-10387**  
**LANI5 HYDROGEN-ABSORPTION CRYOGENIC SYSTEM**  
J. A. JONES (Caltech)  
Jan. 1986
- NPO-16314** **Vol. 9, No. 3, P. 144**  
Hydrogen-absorption refrigerating system provides about 650 mW of cooling at 20 to 29 K in continuous, closed-cycle operation. Three thermally cycled absorbers/desorbers act as compressors. System successfully tested below 29 K for over 1,000 h, while separate room-temperature hydride compressor operated continuously for 6,000 h. Due to lack of moving parts, lifetimes of 10 years or more eventually expected.
- B85-10388**  
**PULSED, HYDRAULIC COAL-MINING MACHINE**  
E. R. COLLINS JR (Caltech)  
Jan. 1986
- NPO-15859** **Vol. 9, No. 3, P. 145**  
In proposed coal-cutting machine, piston forces water through nozzle, expelling pulsed jet that cuts into coal face. Spring-loaded piston reciprocates at end of travel to refill water chamber. Machine a onecylinder, two-cycle, internal-combustion engine, fueled by gasoline, diesel fuel, or hydrogen. Fuel converted more directly into mechanical energy of water jet.
- B85-10389**  
**SYNTHESIS AND OPTIMIZATION OF SPIRAL BEVEL GEARS**  
F. L. LITVIN (University of Illinois), P. RAHMAN (University of Illinois), and R. N. GOLDRICH (University of Illinois)  
Jan. 1986 See Also (N82-25516)
- LEW-13920** **Vol. 9, No. 3, P. 146**  
Two mathematical models help in optimizing design of spiral bevel gears. In essence, replace actual generated tooth surface with mathematical conjugate approximation. Tooth surfaces of spiral bevel gears replaced (or approximated) by conjugate tooth surfaces. Surfaces generated by two conical surface's rigidly connected with each other and in linear tangency along common generatrix of tool cones and by conical surface and surface of revolution in linear tangency along circle. Gears have widespread applications in transmission systems of helicopters, airplanes, trucks, automobiles, tanks, and many other machines.
- B85-10390**  
**PUNCTURE-TOLERANT HEAT RADIATOR**  
D. G. ELLIOTT (Caltech)  
Jan. 1986
- NPO-16401** **Vol. 9, No. 3, P. 147**  
Heat radiator does not lose coolant through small punctures and does not require heavy, cumbersome shielding as protection against punctures. Small holes in radiator cause no outpouring of coolant; only small amount evaporates through hole leaves system. Film of silicone oil flows along interior surface of aluminum shell, transferring much of its heat to shell and outside. Unit provides cooling for 100-kW nuclear powerplant.
- B85-10391**  
**DOLLY SWIVEL FOR FORKLIFT**  
J. T. JONES (Rockwell International Corp.) and P. B. ARBINO (Rockwell International Corp.)  
Jan. 1986
- MFS-19866** **Vol. 9, No. 3, P. 148**  
Adapter enables large dolly towed or pushed by forklift truck and swivel on forklift on turns. Adapter prevents dolly from slipping off forks and damaging loads. Swivel adapter rests on forklift and provides pivot for towing dolly.
- B85-10392**  
**LIGHTWEIGHT, SWITCHABLE PERISTALTIC PUMP**  
R. R. BELOW  
Jan. 1986
- MFS-28059** **Vol. 9, No. 3, P. 148**  
Peristaltic pump moves liquids through 50 or more channels simultaneously. Special feature of pump pressure plates remotely set between idle and operating positions. In new design, unnecessary to preposition pressure plates and, unnecessary to enter pump housing to move plates into operating mode.
- B85-10393**  
**BISTABLE ARTICULATED JOINT**  
N. D. CRAIGHEAD (Lockheed Missiles & Space Co., Inc.), R. J. PRELIASCO (Lockheed Missiles & Space Co., Inc.), and T. D. HULT (Lockheed Missiles & Space Co., Inc.)  
Jan. 1986
- NPO-16038** **Vol. 9, No. 3, P. 149**  
Joint with four-bar-linkage geometry has following attributes: Springs to fully extended fully folded positions. Automatically locks in its extended position. Joint combines zero backlash, positive locking, and centerline pivoting. Used in folding tool handles, portable antenna booms, and many other deployable structures.
- B85-10394**  
**COMPENSATING FOR SHRINKAGE IN MACHINED CERAMICS**  
L. AGUILAR (Lockheed Missiles & Space Co., Inc.) and B. T. FITCHETT (Lockheed Missiles & Space Co., Inc.)  
Jan. 1986
- MSC-20684** **Vol. 9, No. 3, P. 150**  
Technique insures machined ceramics shrink to correct dimensions after baked in kiln. New method automatically compensates during machining for shrinkage later, when part baked. Applicable to numerically controlled machines that include provision to adjust for variations in cuttingtool size, but do not provide for automatic verification of dimensions of machined parts.
- B85-10395**  
**REPLACEABLE TRANSFER TUBE FOR HIGH-PRESSURE CAVITIES**  
D. SORENSEN (Rockwell International Corp.) and J. RIETDYK (Rockwell International Corp.)  
Jan. 1986
- MFS-19775** **Vol. 9, No. 3, P. 151**  
Set of fittings allows fluid injected into inner chamber, passing through two cavities containing fluids at different high pressures. Injection tube readily replaced, and fittings provide tight seal between cavities after replacement. Tube and fittings made from off-the-shelf parts, and familiar to workers and relatively inexpensive.
- B85-10396**  
**HEAT-POWERED PUMP FOR LIQUID METALS**  
R. J. CAMPANA (GA Technologies)  
Jan. 1986
- NPO-16457** **Vol. 9, No. 3, P. 152**  
Proposed thermoelectromagnetic pump for liquid metal powered by waste heat; needs no battery, generator, or other external energy source. Pump turns part of heat in liquid metal into pumping energy. In combination with primary pump or on its own, thermoelectric pump circulates coolant between reactor and radiator. As long as there is decay heat to be removed, unit performs function.

**B85-10397  
FORBIDDEN ZONES FOR NUMERICALLY-CONTROLLED  
MACHINE TOOLS**

D. PHILPOT (Rockwell International Corp.)

Jan. 1986  
MFS-19950

Vol. 9, No. 3, P. 153

Computer-controlled machine tool prevented from striking and damaging protruding members on workpiece by creating forbidden zone in control program. With aid of computer graphics, tool profile and coordinates of forbidden zone digitized and stored in computer memory as part of tool path.

**B85-10398  
DRILLING HOLES IN GRAPHITE/EPOXY COMPOSITES**

J. G. DANIELS, F. E. LEDBETTER, B. G. PENN, and W. L. WHITE

Jan. 1986  
MFS-28044

Vol. 9, No. 3, P. 153

Slurry of silicon carbide powder in water fed onto bit while drilling. Slurry contains about 60 percent silicon carbide by weight. Slurry recirculated by low-power pump. With slurry, dull tools cut as fast as, or faster than, sharp ones. Holes drilled rapidly and efficiently regardless of ply orientation; whether unidirectional, quasi-isotropic symmetrical, or cross-ply.

**B85-10399  
MULTISTAGE PLANETARY POWER TRANSMISSIONS**

G. B. HADDEN (SKF Industries, Inc.), G. J. DYBA (SKF Industries, Inc.), M. A. RAGEN (SKF Industries), R. J. KLECKNER (SKF Industries), and L. SHEYNIN (SKF Industries)

Jan. 1986  
LEW-14100

Vol. 9, No. 3, P. 154

PLANETSYS simulates thermomechanical performance of multistage planetary performance of multistage planetary power transmission. Two versions of code developed, SKF version and NASA version. Major function of program: compute performance characteristics of planet bearing for any of six kinematic inversions. PLANETSYS solves heat-balance equations for either steady-state or transient thermal conditions, and produces temperature maps for mechanical system.

**B85-10400  
THREE-DIMENSIONAL TURBOMACHINE-BLADE-ROW  
ANALYSIS CODE**

A. J. GLASSMAN and J. R. WOOD

Jan. 1986  
LEW-14061

Vol. 9, No. 3, P. 154

Computer program (MERNEW3D) developed that prepares bulk of input data set required for Denton three-dimensional inviscid turbomachine-blade-row analysis code. Denton input generated from minimum of geometry and flow-variable information by using cubic spline curve fits for interpolation and extrapolation. Curve-fitting procedures taken from previously developed and widely used NASA computer program (MERIDL), which performs meridional streamsurface analysis.

**B85-10401  
PREDICTING THE DYNAMIC BEHAVIOR OF HIGH-SPEED  
ROLLER BEARINGS**

T. F. CONRY (University of Illinois)

Jan. 1986  
LEW-13467

Vol. 9, No. 3, P. 155

Computer program developed for solving nonlinear differential equations of motion of high-speed, lightly loaded, cylindrical roller bearing. Program organized into three major parts: Main program, controls input and output; differential equation solver; and subroutines, used to evaluate vector function. Program has capability of performing either twodimensional or three-dimensional simulation.

**B85-10402  
OFF-DESIGN PERFORMANCE OF RADIAL-INFLOW  
TURBINES**

P. L. MEITNER and A. J. GLASSMAN

Jan. 1986  
LEW-14060

Vol. 9, No. 3, P. 155

Computer code determines rotor exit flow from hub to tip. RTOD (Radial Turbine Off-Design), computes off-design performance of radial turbine by modeling flow with stator viscous and trailing-edge losses, and with vaneless space loss between stator and rotor, and with rotor incidence, viscous, clearance, trailing-edge, and disk friction losses.

**B85-10542  
PUMPED, TWO-PHASE HEAT-TRANSFER LOOP**

F. EDELSTEIN (Grumman Aerospace Corp.)

Mar. 1986  
MSC-20841

Vol. 9, No. 4, P. 152

Two-phase heat-transfer system delivers coolant to equipment as liquid and removes it as vapor. Alternatively, system heats equipment by delivering vapor and removing condensed liquid. Two-phase scheme effective for heat transfer over long distances. Heat-transfer plates remove heat from or supply heat to equipment. If temperature of plate is high, valve opens liquid-supply line to plate, and cooling results. If plate temperature is low, valve opens liquid-suction line to plate, and heating ensues.

**B85-10543  
HYDROGEN REFRIGERATOR WOULD COOL BELOW 10  
K**

J. A. JONES (Caltech)

Mar. 1986  
NPO-16393

Vol. 9, No. 4, P. 153

Closed-cycle hydrogen refrigerator uses low-level heat energy to cool objects to temperature of 10 K. Refrigerator needs only fraction of energy of previous equipment with similar low-temperature capability. Unit compact and light in weight. With valves as only moving parts, reliable for many years. Refrigeration concept adapted to cooling superconducting magnets on magnetically levitated railcars, nuclear-particle accelerators, and variety of other cryogenic equipment.

**B85-10544  
AGGLOMERATION-FREE DISTRIBUTOR FOR FLUIDIZED  
BEDS**

F. OUYANG (Institute of Chemical Metallurgy), A. SINICA (Oregon State University), and O. LEVENSPIEL (Oregon State University)

Mar. 1986  
NPO-16466

Vol. 9, No. 4, P. 154

New gas distributor for fluidized beds prevents hot particles from reacting on it and forming hard crust. In reduction of iron ore in fluidized bed, ore particles do not sinter on distributor and perhaps clog it or otherwise interfere with gas flow. Distributor also relatively cool. In fluidized-bed production of silicon, inflowing silane does not decompose until within bed of hot silicon particles and deposits on them. Plates of spiral distributor arranged to direct incoming gas into spiral flow. Turbulence in flow reduces frequency of contact between fluidized-bed particles and distributor.

**B85-10545  
ADJUSTABLE-ANGLE DRILL BLOCK**

F. H. GALLIMORE (McDonnell Douglas Corp.)

Mar. 1986  
LAR-13101

Vol. 9, No. 4, P. 154

Adjustable angular drill block accurately transfers hole patterns from mating surfaces not normal to each other. Block applicable to transfer of nonperpendicular holes in mating contoured assemblies in aircraft industry. Also useful in general manufacturing to transfer mating installation holes to irregular and angular surfaces.

## 07 MACHINERY

**B85-10546**

### **ROTARY JOINT FOR HEAT TRANSFER**

R. SHAUBACK (Thermacore, Inc.)

Mar. 1986

**MFS-26015**

**Vol. 9, No. 4, P. 155**

Rotary joint exchanges heat between two heat pipes - one rotating and one stationary. Joint accommodates varying heat loads with little temperature drop across interface. According to concept, heat pipe enters center of disklike stationary section of joint. There, wicks in central artery of heat pipe separate into multiple strands that lead to concentric channels on rotary interface side of stationary disk. Thin layer of liquid sodium/potassium alloy carries heat from one member of rotary joint to other. Liquid conducts heat efficiently while permitting relative motion between members. Polypropylene rings contain liquid without interfering with rotation.

**B85-10547**

### **CARBON/CARBON PISTONS FOR INTERNAL COMBUSTION ENGINES**

A. H. TAYLOR

Mar. 1986

**LAR-13150**

**Vol. 9, No. 4, P. 156**

Carbon/carbon piston performs same function as aluminum pistons in reciprocating internal combustion engines while reducing weight and increasing mechanical and thermal efficiencies of engine. Carbon/carbon piston concept features low piston-to-cylinder wall clearance - so low piston rings and skirts unnecessary. Advantages possible by negligible coefficient of thermal expansion of carbon/carbon.

**B85-10548**

### **CALCULATING FLOW-ANGLE DEVIATION IN ROTARY PUMPS**

S. Y. MENG (Rockwell International Corp.) and R. B. FURST (Rockwell International Corp.)

Mar. 1986

**MFS-29062**

**Vol. 9, No. 4, P. 157**

New mathematical formula calculates difference between angle of impeller blade and angle of flow. Formula used for inducers of mixed-flow pumps. With formula, calculations made more quickly and accurately than previously available formulas.

**B85-10549**

### **ROUGH/SMOOTH ROTARY SEAL**

W. C. CHEN (Rockwell International Corp.) and E. D. JACKSON (Rockwell International Corp.)

Mar. 1986

**MFS-19947**

**Vol. 9, No. 4, P. 157**

Rotary seal for turbopump combines low leakage of labyrinth seal with high load capacity of smooth-surface annular seal. New seal acts as strong journal bearing that provides high stiffness - about same as that of ball bearings for turbopump shaft. Seal shares load with ball bearings and prolongs their lives. At same time, seal allows minimal leakage of fluid from pump. By combining leakage control and bearing functions, seal makes multiple seals unnecessary and allows compact design.

**B85-10550**

### **PERISTALTIC PUMP WITH A STABLE OUTPUT**

J. A. CHANDLER

Mar. 1986

**MSC-20907**

**Vol. 9, No. 4, P. 158**

Proposed design for peristaltic pump decreases flow-rate change that results from loss of elasticity. Instead of tubing, new pump uses special flexible liner as pumping channel. Liner molded as single piece of flexible plastic with helical internal channels. Three rollers move around inner wall of liner, compressing channels and forcing liquid before constrictions. As rollers move on, channels open elastically, drawing in liquid from inlet port and making it available when rollers return.

**B85-10551**

### **SYSTEMS ENGINEERING OF ELECTRIC AND HYBRID VEHICLES**

D. W. KURTZ (Caltech) and R. R. LEVIN (Caltech)

Mar. 1986

**NPO-15871**

**Vol. 9, No. 4, P. 159**

Technical paper notes systems engineering principles applied to development of electric and hybrid vehicles such that system performance requirements support overall program goal of reduced petroleum consumption. Paper discusses iterative design approach dictated by systems analyses. In addition to obvious performance parameters of range, acceleration rate, and energy consumption, systems engineering also considers such major factors as cost, safety, reliability, comfort, necessary supporting infrastructure, and availability of materials.

**B85-10552**

### **VIBRATIONAL EFFECTS OF TURBOPUMP HOUSING FLEXIBILITY**

J. R. FENWICK (Rockwell International Corp.) and R. B. TARN (Rockwell International Corp.)

Mar. 1986 See Also (N84-33811)

**MFS-27083**

**Vol. 9, No. 4, P. 160**

Methods of computer simulation of turbopump vibrations described in report. For aircraft and aerospace service, high-speed, high-performance turbomachinery should be as light in weight as possible. Certain amount of mass needed in turbomachine housing for stiffness. Report addresses question of how much extra weight is necessary. Analyses shows under certain conditions, flexible housing more stable than rigid one.

**B85-10553**

### **DYNAMIC EFFECTS OF INTERNAL SPUR-GEAR DRIVES**

A. PRINTZ (Cleveland State University), R. KASUBA (Cleveland State University), J. L. FRATER (Cleveland State University), and R. AUGUST (Cleveland State University)

Mar. 1986

**LEW-14167**

**Vol. 9, No. 4, P. 161**

Set of computer programs developed for studying dynamic effects of internal spur-gear drives. New analysis procedure used for gear combinations leading up to and exceeding 'very high contact ratio' (VHCR) of three. Parametric studies with new computer programs revealed impressive list of advantages of internal spur-gear drives over external spur-gear drives.

## 08 FABRICATION TECHNOLOGY

**B85-10122**

### **HYBRID CONTACTLESS HEATING AND LEVITATION**

M. C. LEE (CALTECH)

Jun. 1985

**NPO-15657**

**Vol. 9, No. 1, P. 144**

Acoustic and electromagnetic fields applied. In contactless processing apparatus, acoustic and electromagnetic levitating fields employed alternately or simultaneously with amplitude of each controlled to produce various combinations of heating, cooling, and levitation. Apparatus provides rapid heating and cooling or slow heating and cooling for such processes as nucleation, crystallization, incubation, deep undercooling, and heterogeneity control.

**B85-10123**

### **PHOTOVOLTAIC-PANEL LAMINATOR**

R. KEENAN (Arco Solar, Inc.)

Jun. 1985

**NPO-16092****Vol. 9, No. 1, P. 145**

Two-piece unit heats and presses protective layers to form laminate. Rubber diaphragm between upper and lower vacuum chambers alternates between neutral position and one that presses against solar-cell array, supplying distributed force necessary to press layers of laminate together. Encapsulation helps to protect cells from environment and to ensure long panel life while allowing efficient generation of electricity from Sunlight.

**B85-10124****SERIES CONNECTION OF SOLAR CELLS**

R. KEENAN (Arco Solar, Inc.)

Jun. 1985

**NPO-16091****Vol. 9, No. 1, P. 145**

Roll soldering from continuous string of cells. Automatic, continuous process attaches interconnecting strips to series string of silicon solar cells. Manufacturing process attaches each conductor from positive side of one cell to negative side of next. For reliability, 22 contacts are soldered on each side of each cell.

**B85-10125****PERFORATING THIN METAL SHEETS**

M. E. DAVIDSON (Hughes Aircraft Co.)

Jun. 1985

**ARC-11280****Vol. 9, No. 1, P. 146**

Sheets only few mils thick bonded together, punched, then debonded. Three-step process yields perforated sheets of metal. (1): Individual sheets bonded together to form laminate. (2): laminate perforated in desired geometric pattern. (3): After baking, laminate separates into individual sheets. Developed for fabricating conductive layer on blankets that collect and remove ions; however, perforated foils have other applications - as conductive surfaces on insulating materials; stiffeners and conductors in plastic laminates; reflectors in antenna dishes; supports for thermal blankets; lightweight grille cover materials; and material for mockup of components.

**B85-10126****PRECISE FABRICATION OF ELECTROMAGNETIC-LEVITATION COILS**

E. ETHRIDGE, P. CURRERI, J. THEISS, and G. AB-BASCHIAN (University of Florida)

Jun. 1985

**MFS-25986****Vol. 9, No. 1, P. 146**

Winding copper tubing on jig ensures reproducible performance. Sequence of steps insures consistent fabrication of levitation-and-melting coils. New method enables technician to produce eight coils per day, 95 percent of them acceptable. Method employs precise step-by-step procedure on specially designed wrapping and winding jig.

**B85-10127****SCREW-RETAINING ALLEN WRENCH**

D. GRANETT (CALTECH)

Jun. 1985

**NPO-16275****Vol. 9, No. 1, P. 148**

Steadying screws with fingers unnecessary. Crimp in uncompressed spring wire slightly protrudes from one facet of Allen wrench. Compressed spring retains Allen screw. Tool used with Allen-head screws in cramped spaces with little or no room for fingers to hold fastener while turned by wrench.

**B85-10128****MAKING STRONGER TWINE WITH MATCHED STRANDS**

W. L. KIRKLAND (West Coast Netting, Inc.)

Jun. 1985

**MSC-20444****Vol. 9, No. 1, P. 148**

Higher tensile strength achieved with same production equipment. Strong twine made by using spools in one of two-step manufacturing process. Three primary strands twisted together in opposite direction to form threeply twine. Technique used successfully in manufacture of safety

netting with 600- to 700-lb (2,700-to 3,100-N) tensile strength and 60-ton (54 x 10 to third power kg) tuna seine with area of 86 acres (3.5 x 10 to fifth power m<sup>2</sup>). Increase in tensile strength of completed twine found experimentally 10 to 12 percent.

**B85-10129****UNIVERSAL CABLE BRACKETS**

C. VANVALKENBURGH (Essex Corporation)

Jun. 1985

**MFS-26001****Vol. 9, No. 1, P. 149**

Concept allows routing easily changed. No custom hardware required in concept. Instead, standard brackets cut to length and installed at selected locations along cable route. If cable route is changed, brackets simply moved to new locations. Concept for 'universal' cable brackets make it easy to route electrical cable around and through virtually any structure.

**B85-10130****BONDED AND BOLTED GRAPHITE/POLYIMIDE COMPOSITE JOINTS**

D. E. SKOUMAL (Boeing Aerospace Co.) and J. B. CUSHMAN (Boeing Aerospace Co.)

Jun. 1985 See Also NASA CR-3601 (N83-16786/NSP)

**LAR-13090****Vol. 9, No. 1, P. 150**

Four types of high-temperature joints designed for control surfaces. Design, analysis, and testing performed to develop four types of graphite/polyimide bonded and bolted composite joints for lightly loaded control surfaces on advanced transportation systems that operate at temperatures up to 550 degrees F (288 degrees C).

**B85-10131****SPRAY APPLICATION OF RAPIDLY SOLIDIFIED METALS**

H. P. CHU and C. L. STAUGAITIS

Jun. 1985

**GSC-12880****Vol. 9, No. 1, P. 150**

Fast and economical process now available. New process applies rapidly solidified (RS) metal coatings to substrates. RS metals made directly from molten material. Have amorphous or microcrystalline structures and yield coatings having superior wear and corrosion resistance. Mixture of RS metal powder and peening particles sprayed from nozzle against surface coated. Powder and peening particles strike surface simultaneously, and impact bonds powder to surface as uniform coating. New process, which employs shot peening, is safe, fast, and inexpensive.

**B85-10132****CUTTING GUIDE FOR FIBROUS SHEETS**

A. WARREN, D. (Rockwell International Corp.)

Jun. 1985

**MSC-20798****Vol. 9, No. 1, P. 151**

Tool facilitates repetitive cutting of fibrous sheets. Flexible aluminum tape allows metal strips folded back on themselves, exposing fresh material for cutting. More than one strip folded back, and cutting width therefore increased in multiples of strip width. Developed for cutting strips of alumina-fiber matting, tool also used on such materials as felts, textiles, and sheet metals.

**B85-10133****COPYBOARD QUICKLY MAKES CLEAN PRINTING PLATES**

W. D. BALANDIS

Jun. 1985

**ARC-11365****Vol. 9, No. 1, P. 152**

Vacuum-chuck eliminates glass and sponge artwork support. Vacuum copyboard allows camera-ready original sld on top plate for proper positioning, then holds securely for photography. Bleed valve allows vacuum in copyboard box adjusted for small or large originals. With new copyboard, time-consuming and costly procedures unnecessary.

## 08 FABRICATION TECHNOLOGY

**B85-10266**

### **PRETINNING NICKEL-PLATED WIRE SHIELDS**

J. A. IGAWA (TRW, Inc.)

Oct. 1985

**MSC-20712**

**Vol. 9, No. 2, P. 152**

Nickel-plated copper shielding for wires pretinned for subsequent soldering with help of activated rosin flux. Shield cut at point 0.25 to 0.375 in. (6 to 10 mm) from cut end of outer jacket. Loosened end of shield straightened and pulled toward cut end. Insulation of inner wires kept intact during pretinning.

**B85-10267**

### **HIGH-TEMPERATURE, HIGH-PRESSURE OPTICAL CELLS**

R. P. HARRIS, L. R. HOLLAND (University of Alabama), and R. E. SMITH (University of Alabama)

Oct. 1985

**MFS-26000**

**Vol. 9, No. 2, P. 152**

Optical cell constructed for measurement of thermal diffusivity of HgCdTe semiconductor by laser pulses. Container allows radiation from laser to enter one side of alloy sample, while allowing lower-energy infrared radiation to leave opposite side of sample so temperature rise read by sensor. Composed entirely of fused silica, cell includes two optical windows joined by tube. Cell withstands 1,000 degrees C cell-operating temperature and contains molten alloy at its 100-atmosphere vapor pressure. Finally, allows alloy to solidify without bursting even though alloy expands on cooling.

**B85-10268**

### **MAKING STRUCTURAL MEMBERS FROM WIRE**

T. J. DUNN

Oct. 1985

**MSC-20175**

**Vol. 9, No. 2, P. 153**

Structural members of any size, consisting of wire gridwork, fabricated onsite. Rigid beam or column formed from intersecting helices and straight members of relatively flexible wire. Wires joined at their intersections: short wire sections between joints therefore approximate sides of rigid triangular structural subunits. Although originally intended for manufacturing large structures in space, technique has potential for use on Earth.

**B85-10269**

### **SILICONE-RUBBER STITCHING SEAL**

D. S. WANG (Rockwell International Corp.)

Oct. 1985

**MSC-20708**

**Vol. 9, No. 2, P. 154**

Fabric products protected from raveling by coating threads and filling stitching holes with silicone rubber. Uncured silicone rubber applied to stitching lines with air-pressurized sealant gun. Next, plastic release film placed on coated side, and blanket flipped over so release film lies underneath. Blanket then bagged and adhesive cured under partial vacuum of about 3.5 psi or under pressure. Applications include balloons, parachutes, ultralight aircraft, sails, rescue harnesses, tents, or other fabric products highly stressed in use.

**B85-10270**

### **CENTRIFUGAL GENERATOR OF FILLED SPHERICAL SHELLS**

T. G. WANG (Caltech), D. GRANETT (Caltech), and W. M. AKUTAGAWA (Caltech)

Oct. 1985

**NPO-16051**

**Vol. 9, No. 2, P. 155**

Centrifugal apparatus produces filled spherical shells for wide range of industrial and scientific applications. Rotating container has radially extending nozzle in which centrifugal force draws liquid shell material from container. Liquid shell material fed from outside container and automatically maintained at fixed level. Along axis of nozzle is tube that connects through rotating seal to source of gas or other

filler material. Material-flow and rotation rates adjusted to change bubble size.

**B85-10271**

### **ALINING LARGE CYLINDERS FOR WELDING**

J. H. EHL

Oct. 1985

**MFS-28001**

**Vol. 9, No. 2, P. 156**

Special tooling aligns and holds internally-stiffened large-diameter cylindrical parts for welding. Alignment brackets attached to strengthening fins on insides of cylindrical tank sections. Jackscrews on brackets raised or lowered to eliminate mismatches between adjacent sections. Tooling substantially reduces costs while allowing more precise control and improved quality.

**B85-10272**

### **PROTOTYPE FURNACE FOR AUTOMATIC PRODUCTION OF SILICON RIBBON**

C. S. DUNCAN (Westinghouse Electric Corp.) and W. B. STICKEL (Westinghouse Electric Corp.)

Oct. 1985

**NPO-16175**

**Vol. 9, No. 2, P. 156**

Single-crystal material grown under precise control. New furnace permits sustained growth of single-crystal silicon ribbon by dendritic-web growth process. Furnace brings together mechanisms necessary for continuous automatic operation.

**B85-10273**

### **FABRICATION OF SLENDER STRUTS FOR DEPLOYABLE ANTENNAS**

H. G. BUSH, R. M. BLUCK (Lockheed Missiles and Space Co., Inc.), and R. R. JOHNSON (Lockheed Missiles and Space Co., Inc.)

Oct. 1985

**LAR-13136**

**Vol. 9, No. 2, P. 157**

High moduli of elasticity potentially achievable. Suited for application in large diameter antennas on orbiting spacecraft. Fabrication process can accurately place dry graphite fibers and overwrap them with aluminum foil, resulting in straight, slender graphite tubes. Graphite fibers pulled out of creoled spools and fed through ceramic eyelets. Spools of aluminum foil mounted on rotating ring and capture graphite fiber as vertical winding machine carriage moves upward. Epoxy resin applied by mechanically spreading epoxy on tetrafluoroethylene mandrel by means of doctor blade attached to carriage.

**B85-10274**

### **DUPLICATING CURVED TILE SURFACES FOR PULL TESTING**

R. H. SEBENICK (Rockwell International Corp.)

Oct. 1985

**MSC-20795**

**Vol. 9, No. 2, P. 158**

Strength of adhesive bonds to fragile objects with complex shapes tested easily with vacuum chucks. In bond-strength test, contact surface of chuck pressed against matching surface of bonded tile. Vacuum line extending through fine bore in chuck creates vacuum at chuck-and-tile interface. Thus, when chuck pulled away, atmospheric pressure tends to push tile away with chuck. If adhesive resists predetermined pull exerted by chuck on tile, bond acceptable. Originally developed for vacuum chucks used on silica tiles attached to outer surface of Space Shuttle orbiter, used to custom-fabricate chuck for specific tile.

**B85-10275**

### **ADJUSTABLE LID AIDS SILICON-RIBBON GROWTH**

J. P. MCHUGH (Westinghouse Electric Corp.), R. G. STEIDENSTICKER (Westinghouse Electric Corp.), and C. S. DUNCAN (Westinghouse Electric Corp.)

Oct. 1985

**NPO-16354**

**Vol. 9, No. 2, P. 159**

Closely-spaced crucible cover speeds up solidification. Growth rate of dendritic-web silicon ribbon from molten

silicon increased by controlling distance between crucible susceptor lid and liquid/solid interface. Lid held in relatively high position when crucible newly filled with chunks of polycrystalline silicon. As silicon melts and forms pool of liquid at lower level, lid gradually lowered.

**B85-10276**  
**MAKING GLASS-FIBER-REINFORCED COOLANT TUBES**  
 F. CURTIN (United Technologies Corporation)  
 Oct. 1985

**MSC-20677** Vol. 9, No. 2, P. 159  
 New use found for heat-shrinkable sleeves. Smooth, noncontaminating channels for transporting cooling water in Space Shuttle Extravehicular-mobility unit made of fiber-glass tubing with aid of heat-shrinkable sleeves. Previously, glass fibers from inner walls of tubes contaminate water.

**B85-10277**  
**CONTROLLING SAMPLE ROTATION IN ACOUSTIC LEVITATION**  
 M. B. BARMATZ (Caltech) and J. D. STONEBURNER (Caltech)  
 Oct. 1985

**NPO-15962** Vol. 9, No. 2, P. 160  
 Rotation of acoustically levitated object stopped or controlled according to phase-shift monitoring and control concept. Principle applies to square-cross-section levitation chamber with two perpendicular acoustic drivers operating at same frequency. Phase difference between X and Y acoustic excitation measured at one corner by measuring variation of acoustic amplitude sensed by microphone. Phase of driver adjusted to value that produces no rotation or controlled rotation of levitated object.

**B85-10278**  
**DAMAGE AND REPAIR OF COMPOSITE STRUCTURES**  
 J. W. DEATON  
 Oct. 1985

**LAR-13146** Vol. 9, No. 2, P. 161  
 NASA technical memorandum reports on research in damage and repair of composite-material structures of types used in airplane. Research includes: Identifying defect areas, determining whether particular kind of damage weakens structure in manner that degrades performance in intended application, developing repair procedures, and testing to demonstrate given repair procedure enables component to serve during remainder of its design life.

**B85-10403**  
**HIGH-EFFICIENCY, LOW-WEIGHT POWER TRANSFORMER**  
 J. P. WELSH (Thermal Technology, Inc.)  
 Jan. 1986 See Also (N83-29596)

**LEW-14074** Vol. 9, No. 3, P. 156  
 Technology for design and fabrication of radically new type of conduction-cooled high-power (25 kVA) lightweight transformer having outstanding thermal and electrical characteristics. Fulfills longstanding need for conduction-cooled transformers and magnetics with low internal thermal resistances. Development techniques limited to conductive heat transfer, since other techniques such as liquid cooling, forced liquid cooling, and evaporative cooling of transformers impractical in zero-gravity space environment. Transformer uniquely designed: mechanical structure also serves as thermal paths for conduction cooling of magnetic core and windings.

**B85-10404**  
**COATING A SPHERE WITH EVAPORATED METAL**  
 D. M. STRAYER (Caltech), H. W. JACKSON (Caltech), and J. R. GATEWOOD (Caltech)  
 Jan. 1986

**NPO-16436** Vol. 9, No. 3, P. 158  
 In vacuum coating apparatus, metal evaporated onto sphere from small source located some distance away. Sphere held in path of metal vapor while rotated about

axis that rocks back and forth. One tilting motion particularly easy to produce is sinusoidal rocking with frequency much lower than rotational frequency. Apparatus developed for coating single-crystal sapphire spheres with niobium.

**B85-10405**  
**ECONOMICAL FABRICATION OF LARGE PARABOLIC MIRRORS**  
 R. T. SCHNEIDER (University of Florida), U. H. KURZWEG (University of Florida), and J. D. COX (University of Florida)  
 Jan. 1986 See Also (N83-23588)

**LAR-13139** Vol. 9, No. 3, P. 159  
 Long-focal-length parabolic mirrors fabricated economically by rotational casting. Technique applies to very large mirrors and incorporates new foam/fiberglass techniques ideal for producing rigid, lightweight mirrors. Process developed to produce mirrors that concentrate Sunlight for solar pumped laser.

**B85-10406**  
**HIGH-QUALITY, THIN-FILM GERMANIUM SINGLE CRYSTALS**  
 R. A. OUTLAW and J. HOPSON, P.  
 Jan. 1986

**LAR-13211** Vol. 9, No. 3, P. 162  
 Germanium (Ge) has crystallographic characteristics similar to GaAs and compatible with heteroepitaxial growth of GaAs. Further, since efficient heteroface cells already grown on thick Ge single crystals, Ge is excellent substrate candidate for thin-film cells. Required is single-crystal Ge thin film. Method developed for epitaxially growing high-quality 10-um Ge thin films on 100. NaCl substrates by plasma-enhanced chemical-vapor deposition (PECVD) and then separating Ge films by either melt-away or differential-thermal shear stress techniques. Free-standing films used for growth of Al<sub>x</sub>Ga<sub>1-x</sub>As/GaAs heteroface cells by similar techniques.

**B85-10407**  
**SUPPORTING STRUCTURES FOR FLAT SOLAR-CELL ARRAYS**  
 A. H. WILSON (Caltech)  
 Jan. 1986 See Also (N81-30558)

**NPO-15600** Vol. 9, No. 3, P. 163  
 Strong supporting structures for flat solar photovoltaic arrays built with such commonly available materials as wood and galvanized steel sheet. Structures resist expected static loads from snow and ice as well as dynamic loads from winds and even Earthquake vibrations. Supporting structure uses inexpensive materials. Parts prefabricated to minimize assembly work in field.

**B85-10408**  
**METALIZATION PATTERNS BY THERMAL DECOMPOSITION**  
 B. D. GALLAGHER (Caltech)  
 Jan. 1986

**NPO-16413** Vol. 9, No. 3, P. 163  
 Metal interconnection pattern deposited on integrated circuit or solar cell economically by thermal decomposition of metallo-organic compound. In proposed process beam from laser or quartz lamp swept over substrate in required metalization pattern; wherever beam impinges on substrate, radiant heat decomposes compound, depositing metal. Process requires less costly equipment and less time than conventional metalization. Process readily adaptable to very-large-scale integrated (VLSI) circuits.

**B85-10409**  
**IMPROVED SURFACE OF TITANIUM STRUCTURE**  
 R. C. ECKLUND (McDonnell Douglas Corp.), M. HAYASE (McDonnell Douglas Corp.), and K. K. YASUI (McDonnell Douglas Corp.)  
 Jan. 1986

**LAR-13148** Vol. 9, No. 3, P. 164  
 Potential tooling pickup not acceptable on sandwich

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes the need for transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. It includes a detailed description of the experimental procedures and the tools used for data collection.

3. The third part of the document presents the results of the study. It includes a series of tables and graphs that illustrate the findings. The data shows a clear trend in the relationship between the variables being studied.

4. The fourth part of the document discusses the implications of the findings. It highlights the potential applications of the research in various fields and the need for further investigation in this area.

5. The fifth part of the document concludes the study. It summarizes the key findings and provides a final statement on the overall significance of the research. The authors express their gratitude to the funding agencies and the participants who made the study possible.

6. The final part of the document includes a list of references and a list of authors. The references cite the works of other researchers in the field, and the authors provide their contact information for further inquiries.

gates. Encoding and decoding logic implement generator polynomial that defines error-correcting code, and error correction based on algorithm also implemented by logic.

**B85-10139**  
**VECTOR LYAPUNOV FUNCTIONS FOR STOCHASTIC INTERCONNECTED SYSTEMS**  
D. BOUSSALIS (CALTECH)  
Jun. 1985  
NPO-16170 **Vol. 9, No. 1, P. 158**

Theoretical paper presents set of sufficient conditions for asymptotic and exponential stability with probability 1 for class of stochastic interconnected systems. Theory applicable to complicated, large-scale mechanical or electrical systems, and, for several design problems, it reduces computational difficulty by relating stability criteria to fundamental structural features of system.

**B85-10279**  
**FREE-VIBRATION ANALYSIS OF STRUCTURES**  
K. K. GUPTA (Caltech)  
Oct. 1985  
NPO-15000 **Vol. 9, No. 2, P. 162**

Improved numerical procedure more than twice as fast as previous methods. Unified numerical algorithm efficiently solves free-vibration problems of stationary or spinning structures with or without viscous or structural damping. Algorithm used to solve static problems involving multiple loads and to solve quadratic matrix eigenvalue problems associated with finite-dynamic-element structural discretization.

**B85-10280**  
**PREDICTION OF COMBUSTION GAS DEPOSIT COMPOSITIONS**  
F. J. KOHL, B. J. MCBRIDE, F. J. ZELEZNIK, and S. GORDON  
Oct. 1985  
LEW-14091 **Vol. 9, No. 2, P. 162**

Demonstrated procedure used to predict accurately chemical compositions of complicated deposit mixtures. NASA Lewis Research Center's Computer Program for Calculation of Complex Chemical Equilibrium Compositions (CEC) used in conjunction with Computer Program for Calculation of Ideal Gas Thermodynamic Data (PAC) and resulting Thermodynamic Data Base (THDATA) to predict deposit compositions from metal or mineral-seeded combustion processes.

**B85-10281**  
**DESIGN LANGUAGE FOR DIGITAL SYSTEMS**  
S. G. SHIVA (University of Alabama)  
Oct. 1985  
MFS-25352 **Vol. 9, No. 2, P. 163**

Digital Systems Design Language (DDL) is convenient hardware description language for developing and testing digital designs and for inputting design details into design automation system. Describes digital systems at gate, register transfer, and combinational block levels. DDL-based programs written in FORTRAN IV for batch execution.

**B85-10282**  
**MANIPULATION AND DISPLAY OF PANEL-METHOD GEOMETRY**  
J. F. HALL (Kentron International, Inc.), D. H. NEUHART (Kentron International, Inc.), and K. B. WALKLEY (Kentron International, Inc.)  
Oct. 1985  
LAR-13224 **Vol. 9, No. 2, P. 164**

GEOM manipulates and displays any geometry data expressed in Hess format. Provides user with capability to manipulate, modify, and view such geometric configurations interactively. GEOM program and the PAGMS data-base management system written in FORTRAN IV.

**B85-10283**  
**ANALYSIS OF SATELLITE COMMUNICATION ANTENNA PATTERNS**  
Y. RAHMAT-SAMII (Caltech)  
Oct. 1985  
NPO-16400 **Vol. 9, No. 2, P. 164**

Computer program accurately and efficiently predicts far-field patterns of offset, or symmetric, parabolic reflector antennas. Antenna designer uses program to study effects of varying geometrical and electrical (RF) parameters of parabolic reflector and its feed system. Accurate predictions of far-field patterns help designer predict overall performance of antenna. These reflectors used extensively in modern communications satellites and in multiple-beam and low side-lobe antenna systems.

**B85-10284**  
**AN INTERACTIVE PLOTTING ROUTINE**  
D. W. BOWDISH (Rockwell International Corp.)  
Oct. 1985  
MSC-20771 **Vol. 9, No. 2, P. 164**

Routine called CRTRPM meets needs of applications programmer to plot data in interactive environment on Tektronix graphics terminal. CRTRPM designed specifically for applications where data is viewed and responded to at terminal. CRTRPM produces from one to four grids on terminal screen at one time, with from one to ten plots of X-Y data on each grid. CRTRPM written in FORTRAN V for interactive execution.

**B85-10285**  
**PROCESSING DIGITAL IMAGERY DATA**  
P. K. CONNER, B. G. JUNKIN, M. H. GRAHAM, M. T. KALCIC, and B. R. SEYFARTH  
Oct. 1985  
MFS-25987 **Vol. 9, No. 2, P. 165**

Earth Resources Laboratory Applications Software (ELAS) is geobased information system designed for analyzing and processing digital imagery data. ELAS offers user of remotely sensed data wide range of easy to use capabilities in areas of land cover analysis. ELAS system written in FORTRAN and Assembler for batch or interactive processing.

**B85-10286**  
**PERSONAL-COMPUTER VIDEO-TERMINAL EMULATOR**  
R. H. BUCKLEY, A. KOROMILAS (Boeing Services International), R. M. SMITH (Boeing Services International), G. E. LEE (Boeing Services International), and E. W. GIERING (Boeing Services International)  
Oct. 1985  
KSC-11293 **Vol. 9, No. 2, P. 165**

OWL-1200 video terminal emulator has been written for IBM Personal Computer. The OWL-1200 is a simple user terminal with some intelligent capabilities. These capabilities include screen formatting and block transmission of data. Emulator is written in PASCAL and Assembler for the IBM Personal Computer operating under DOS 1.1.

**B85-10287**  
**STANDARD CODES FOR TELEMETRY AND TELECOMMAND**  
M. L. MACMEDAN (Caltech)  
Oct. 1985  
NPO-16305 **Vol. 9, No. 2, P. 165**

Different systems communicate and development costs reduced. Report discusses efforts to standardize telemetry and telecommand codes of various space programs. Used to detect and correct bit errors in communication channels with low signal-to-noise ratios, codes proliferated in recent years. Each coding/decoding system developed to solve specific problem, but some systems are similar and exhibit similar performance.

**B85-10411**  
**CODING FOR ELECTRONIC MAIL**

## 09 MATHEMATICS AND INFORMATION SCIENCES

R. F. RICE (Caltech) and J. J. LEE (Caltech)  
Jan. 1986 See Also (N84-16429)

**NPO-16350** Vol. 9, No. 3, P. 166

Scheme for coding facsimile messages promises to reduce data transmission requirements to one-tenth current level. Coding scheme paves way for true electronic mail in which handwritten, typed, or printed messages or diagrams sent virtually instantaneously - between buildings or between continents. Scheme, called Universal System for Efficient Electronic Mail (USEEM), uses unsupervised character recognition and adaptive noiseless coding of text. Image quality of resulting delivered messages improved over messages transmitted by conventional coding. Coding scheme compatible with direct-entry electronic mail as well as facsimile reproduction. Text transmitted in this scheme automatically translated to word-processor form.

### **B85-10412** **IMPROVED NUMERICAL EVALUATION METHOD FOR ELLIPTIC INTEGRALS**

V. J. ROSSOW

Jan. 1986

**ARC-11467** Vol. 9, No. 3, P. 168

Two modifications to Bartky's method for numerical evaluation of complete elliptic integrals increase rate of convergence and eliminate loss of accuracy due to round-off errors. Other integrals (nonelliptic) evaluated by manipulating integrand into form  $F(R)/R$  required for evaluation by this method. Improved method used to map upper half of complex plane conformally onto interior of exterior of round-nosed wedges of various angles.

### **B85-10413** **THREE-DIMENSIONAL GRIDS FOR FLOW-FIELD CALCULATIONS**

P. D. THOMAS (Lockheed Aircraft Co.)

Jan. 1986

**ARC-11394** Vol. 9, No. 3, P. 169

New procedure generates boundary-conforming three-dimensional grids suitable for calculating flow fields around bodies with complex shapes. Extension of earlier methods limited to mapping two-dimensional flow regions onto rectangular grids in transformed planes. Technique also useful in solving thermodynamic and electrostatic fields near complex surfaces.

### **B85-10414** **COMPUTING RELATIVE JOINT POSITIONS OF ROBOT ARMS**

L. K. BARKER

Jan. 1986 See Also (N83-34661)

**LAR-13264** Vol. 9, No. 3, P. 170

Vector-algebra method developed for extracting Denavit-Hartenberg parameters for any assembled robot arm. Method for extracting relative joint geometry of robot arms useful to researchers who need data for existing robot arms for either validation of mathematical models or for studies involving actual control of these devices. Method, does not require robot arm to be disassembled, also useful in recalibration of misaligned or bent robot arm and becomes useful industrial procedure. Merit of method is errors not propagated.

### **B85-10415** **REQUIREMENTS ANALYSIS FOR INFORMATION-INTENSIVE SYSTEMS**

E. D. CALLENDER (Caltech), C. HARTSOUGH (Caltech), R. V. MORRIS (Caltech), and Y. YAMAMOTO (Caltech)

Jan. 1986

**NPO-15944** Vol. 9, No. 3, P. 171

Report discusses role of requirements analysis in development of information-intensive systems. System examined from variety of human viewpoints during design, development, and implementation. Such examination, called requirements analysis, ensures system simultaneously meets

number of distinct but interacting needs. Viewpoints defined and integrated to help attain objectives.

### **B85-10416** **CODING FOR EFFICIENT IMAGE TRANSMISSION**

R. F. RICE (Caltech) and J. J. LEE (Caltech)

Jan. 1986 See Also (N83-28069)

**NPO-16444** Vol. 9, No. 3, P. 171

NASA publication second in series on data-coding techniques for noiseless channels. Techniques used even in noisy channels, provided data further processed with Reed-Solomon or other error-correcting code. Techniques discussed in context of transmission of monochrome imagery from Voyager II spacecraft but applicable to other streams of data. Objective of this type coding to 'compress' data; that is, to transmit using as few bits as possible by omitting as much as possible of portion of information repeated in subsequent samples (or picture elements).

### **B85-10417** **COMPUTATIONAL SIMPLIFICATION OF ROBOT-ARM DYNAMICS**

A. K. BEJCZY (Caltech) and S. LEE (Caltech)

Jan. 1986

**NPO-16377** Vol. 9, No. 3, P. 172

Report presents two general methods for reducing mathematical complexities of state equations of robot-arm dynamics. Robot arms contain both rotary and linear joints. Both methods start with homogenous coordinates and Lagrangian formulation of mechanics briefly summarized in report. First method uses matrix-analysis techniques; second, vector-analysis techniques. Vector-analysis method includes new differential-vector representation of centripetal and Coriolis forces.

### **B85-10418** **MODAL ANALYSIS AND GAIN ESTIMATION**

R. L. JONES

Jan. 1986

**LAR-13334** Vol. 9, No. 3, P. 172

Interactive program yields eigenvectors, eigenvalues, and gains for feedback-control systems. Interactive Modal Analysis and Gain Estimation System (IMAGES) provides eigensystem synthesis capability to control-system engineer, IMAGES modular and flexible. Capable of both modal and spectral synthesis of multi-input control systems. IMAGES user-oriented, interactive program that frees engineer to concentrate on eigensystem synthesis. Engineer provided with scratch-pad capability that speeds control-system design.

### **B85-12419** **TEXT EXCHANGE SYSTEM**

W. V. SNYDER (Caltech) and R. J. HANSON (Sandia National Laboratories)

Jan. 1986

**NPO-16357** Vol. 9, No. 3, P. 173

Text Exchange System (TES) exchanges and maintains organized textual information including source code, documentation, data, and listings. System consists of two computer programs and definition of format for information storage. Comprehensive program used to create, read, and maintain TES files. TES developed to meet three goals: First, easy and efficient exchange of programs and other textual data between similar and dissimilar computer systems via magnetic tape. Second, provide transportable management system for textual information. Third, provide common user interface, over wide variety of computing systems, for all activities associated with text exchange.

### **B85-10420** **SUBSET REGRESSION**

A. G. HOLMS

Jan. 1986 See Also (N83-28172)

**LEW-14002** Vol. 9, No. 3, P. 173

Backward elimination procedure minimizes prediction

errors of equations fitted to factorial experiments. Problem of minimizing prediction error solved for two-level full- or fractional-factorial experiment with 16 factorial points and 0 to 6 center points. Such experiment provides 16 orthogonal coefficient estimates for empirical polynomial model. Each coefficient estimated with low variance error estimated from 16 observations.

**B85-10421**  
**SOLVING LARGE SYSTEMS OF NORMAL EQUATIONS**  
 B. PUTNEY (Geodynamics Branch)  
 Jan. 1986  
**GSC-12858**

**Vol. 9, No. 3, P. 173**  
 SOLVE II program combines any number of sets of normal equations and obtains solution vector and related statistics. Normal equations of square, nonnegative definite matrix form. Program utilizes only upper symmetric portion of matrix. Program uses partitioned Cholesky decomposition method for matrix inversion to accommodate large parameter systems.

**B85-10422**  
**TRANSPORTABLE APPLICATIONS EXECUTIVE**  
 M. R. SZCZUR  
 Jan. 1986

**GSC-12881** **Vol. 9, No. 3, P. 174**  
 Transportable Applications Executive (TAE) is collection of 'executive' programs that interact with user to manage execution of application programs. All applications running under TAE have same interface. Since TAE manages entire interactive session, user does not need to know command language of host computer. TAE utilized effectively and efficiently by both first-time user and experienced user. Provides extensive assistance to user at any stage of interactive session.

**B85-10423**  
**TEXT FILE DISPLAY PROGRAM**  
 J. L. VAVRUS (Caltech)  
 Jan. 1986

**NPO-16358** **Vol. 9, No. 3, P. 174**  
 LOOK program permits user to examine text file in pseudorandom access manner. Program provides user with way of rapidly examining contents of ASCII text file. LOOK opens text file for input only and accesses it in blockwise fashion. Handles text formatting and displays text lines on screen. User moves forward or backward in file by any number of lines or blocks. Provides ability to 'scroll' text at various speeds in forward or backward directions.

**B85-10424**  
**DATA MANIPULATION AND DISPLAY**  
 J. R. SZUCH  
 Jan. 1986

**LEW-14101** **Vol. 9, No. 3, P. 174**  
 BDMADS, BASIC Data Manipulation and Display System, is software package that runs on Apple II Plus or IIE personal computer to provide user-friendly environment in which to perform many complex operations on array of numbers.

**B85-10425**  
**FLEXIBLE AIRFRAME RESPONSE PROGRAM**  
 C. LIN (McDonnell Douglas Corp.)  
 Jan. 1986

**MSC-20762** **Vol. 9, No. 3, P. 175**  
 Generalized set of flexible vehicle equations-of-motion (EOM's) developed and incorporated into Flexible Airframe Response (FAR) program. Output from FAR program used in aircraft flight control system design.

**B85-10426**  
**UNIVERSAL NOISELESS CODING SUBROUTINES**  
 A. P. SCHLUTSMAYER (Caltech) and R. F. RICE (Caltech)  
 Jan. 1986

**NPO-15451** **Vol. 9, No. 3, P. 175**  
 Software package consists of FORTRAN subroutines

that perform universal noiseless coding and decoding of integer and binary data strings. Purpose of this type of coding to achieve data compression in sense that coded data represents original data perfectly (noiselessly) while taking fewer bits to do so. Routines universal because they apply to virtually any 'real-world' data source.

**B85-10427**  
**TRASYS FOR BEGINNERS**  
 K. T. SO (Rockwell International Corp.)  
 Jan. 1986 See Also (N82-10754)  
**MSC-20855**

**Vol. 9, No. 3, P. 175**  
 Self-teaching manual designed for first-time users of TRASYS (Thermal Radiation Analysis System), computer program widely used by engineers involved in thermodynamic analyses. Simpler than full TRASYS manual. Readers need no previous knowledge of program or of FORTRAN language in which it is written. Self-teaching manual gives specific instructions in operation of program and three step-by-step examples.

**B85-10558**  
**SYSTEM FOR AUTOMATED TROUBLESHOOTING**  
 L. FRIEDMAN (Caltech)  
 Mar. 1986

**NPO-16339** **Vol. 9, No. 4, P. 168**  
 New algorithms for diagnosing problems in electromechanical systems based on artificial intelligence techniques used to locate faults with minimal human intervention. After given information on system architecture, electrical connections, types of parts, and failure modes, algorithms apply 'reasoning' processes patterned after those of humans.

**B85-10559**  
**GEOMETRIC REPRESENTATIONS FOR DISCRETE FOURIER TRANSFORMS**  
 C. W. CAMPBELL  
 Mar. 1986 See Also (N84-24114)  
**MFS-27072**

**Vol. 9, No. 4, P. 167**  
 Simple geometric representations show symmetry and periodicity of discrete Fourier transforms (DFT's). Help in visualizing requirements for storing and manipulating transform value in computations. Representations useful in any number of dimensions, but particularly in one-, two-, and three-dimensional cases often encountered in practice.

**B85-10560**  
**MAXIMUM-LIKELIHOOD PARAMETER-ESTIMATION ALGORITHM**  
 D. B. ELDRED (Caltech), M. HAMIDI (Caltech), and G. RODRIGUEZ (Caltech)  
 Mar. 1986

**NPO-16320** **Vol. 9, No. 4, P. 168**  
 Efficient version of maximum-likelihood algorithm devised for calculating normal-mode frequencies and damping parameters of vibrating system from experimental data where both process noise and measurement noise present. Method applicable in vibration analysis of such complicated structures as vehicles, aircraft, and spacecraft. New algorithm simplification of existing maximum-likelihood formulation using Kalman filter that allows for both process and measurement noise.

**B85-10561**  
**OPTIMUM CYCLIC REDUNDANCY CODES FOR NOISY CHANNELS**  
 E. C. POSNER (Caltech) and P. MERKEY (Caltech)  
 Mar. 1986

**NPO-16406** **Vol. 9, No. 4, P. 168**  
 Capabilities and limitations of cyclic redundancy codes (CRC's) for detecting transmission errors in data sent over relatively noisy channels (e.g., voice-grade telephone lines or very-high-density storage media) discussed in 16-page report. Due to prevalent use of bytes in multiples of 8 bits data transmission, report primarily concerned with cases in which both block length and number of redundant bits

## 09 MATHEMATICS AND INFORMATION SCIENCES

(check bits for use in error detection) included in each block are multiples of 8 bits.

**B85-10562**

### NUMERICAL AERODYNAMIC SIMULATION FACILITY

V. L. PETERSON, W. F. BALLHAUS JR., and F. R. BAILEY

Mar. 1986

**ARC-11497**

**Vol. 9, No. 4, P. 169**

NASA numerical aerodynamic simulation (NAS) facility described in 22-page report provides advanced computational aerodynamics service by mid- to late-1980's for use by government laboratories, industry, and academia. Facility continually upgraded as computer technology advances. Facility expected to begin operating by late 1985, supports both local and remote users.

**B85-10563**

### COMPARISON OF DECISION MODELS

A. FEINBERG (Caltech), J. R. F. MILES (Caltech), J. H.

SMITH (Caltech), and E. M. SCHEUER (California State

University)

Mar. 1986

**NPO-16446**

**Vol. 9, No. 4, P. 175**

Two methods of multiattribute decision analysis compared in report. One method employs linear utility model. Other utilizes multiplicative utility model. Report based on interviews with experts in automotive technology to obtain their preferences regarding 10 new types of vehicles.

**B85-10564**

### NUMERICAL METHODS FOR CLASSICAL SAMPLED-SYSTEM ANALYSIS

H. P. FRISCH and F. H. BAUER

Mar. 1986

**GSC-12827**

**Vol. 9, No. 4, P. 176**

SAMSAN provides control-system analyst with self-consistent computer algorithms that support large-order control-system design and evaluation studies. Emphasizes sampled-system analysis. SAMSAN reduces burden on analyst by providing set of algorithms well tested and documented and readily integrated for solving control-system problems.

**B85-10565**

### SOFTWARE COMPARISON

D. C. BLANCHARD (McDonnell Douglas Corp.)

Mar. 1986

**MSC-20777**

**Vol. 9, No. 4, P. 176**

Software Comparison Package (SCP) compares similar files. Normally, these are 90-character files produced by CDC UPDATE utility from program libraries that contain FORTRAN source code plus identifier. SCP also used to compare load maps, cross-reference outputs, and UPDATE corrections sets. Helps wherever line-by-line comparison of similarly structured files required.

**B85-10566**

### IMAGE-PROCESSING EDUCATOR

F. J. GUNTHER (Computer Sciences Corp.)

Mar. 1986

**GSC-12933**

**Vol. 9, No. 4, P. 177**

Apple Image-Processing Educator (AIPE) explores ability of microcomputers to provide personalized computer-assisted instruction (CAI) in digital image processing of remotely sensed images. AIPE is 'proof-of-concept' system, not polished production system. User-friendly prompts provide access to explanations of common features of digital image processing and of sample programs that implement these features.

**B85-10567**

### MANIPULATION OF NUMBERS WITH MANY DIGITS

L. W. HOWELL and M. PATRICK

Mar. 1986

**MFS-28048**

**Vol. 9, No. 4, P. 177**

PRECISION designed for manipulation of numbers with

accurate retention of up to thousands of digits per number. Use of PRECISION prevents underflow and overflow in programs that generate extreme numbers such as probability theory, statistics, and scientific applications.

**B85-10568**

### PRINTER GRAPHICS PACKAGE

D. C. BLANCHARD (McDonnell Douglas Corp.)

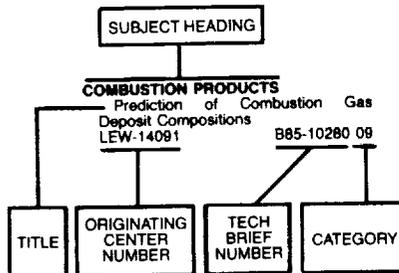
Mar. 1986

**MSC-20778**

**Vol. 9, No. 4, P. 177**

Printer Graphics Package (PGP) is tool for making two-dimensional symbolic plots on line printer. PGP created to support development of Heads-Up Display (HUD) simulation. Standard symbols defined with HUD in mind. Available symbols include circle, triangle, quadrangle, window, line, numbers, and text. Additional symbols easily added or built up from available symbols.

## Typical Subject Index Listing



The title of each Tech Brief is listed under several selected subject headings to provide the user with a variety of approaches in his search for specific information. The Tech Brief number, e.g., B85-10260, is located under and to the right of the title and is followed by a two-digit number, e.g., 09, which designates the subject category in which the entire entry can be found.

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### HYBRID CIRCUITS

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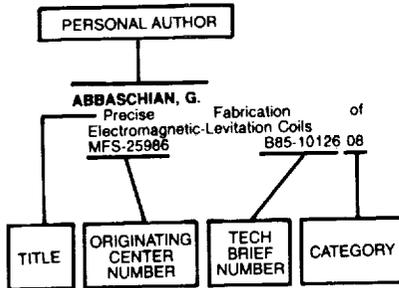
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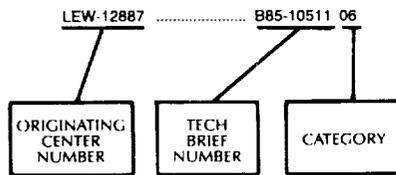
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