

## Software for Managing Parametric Studies

The Information Power Grid Virtual Laboratory (ILab) is a Practical Extraction and Reporting Language (PERL) graphical-user-interface computer program that generates shell scripts to facilitate parametric studies performed on the Grid. ("The Grid" denotes a worldwide network of supercomputers used for scientific and engineering computations involving data sets too large to fit on desktop computers.) Heretofore, parametric studies on the Grid have been impeded by the need to create control language scripts and edit input data files — painstaking tasks that are necessary for managing multiple jobs on multiple computers. ILab reflects an object-oriented approach to automation of these tasks: All data and operations are organized into packages in order to accelerate development and debugging. A "container" or "document" object in ILab, called an "experiment," contains all the information (data and file paths) necessary to define a complex series of repeated, sequenced, and/or branching processes. For convenience and to enable reuse, this object is serialized to and from disk storage. At run time, the current ILab experiment is used to generate required input files and shell scripts, create directories, copy data files, and then both initiate and monitor the execution of all computational processes.

*This program was written by Maurice Yarrow, Karen M. McCann, and Adrian DeVivo of Ames Research Center. For further information, access <http://www.nas.nasa.gov/ILab/>.*

*Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Ames Research Center, (650) 604-5104. Refer to ARC-14649-1.*

## Software Aids Visualization of Computed Unsteady Flow

Unsteady Flow Analysis Toolkit (UFAT) is a computer program that synthesizes motions of time-dependent flows represented by very large sets of data generated in computational fluid dynamics simulations. Prior to the development of UFAT, it was necessary to rely on static, single-snapshot depictions of time-dependent flows generated by

flow-visualization software designed for steady flows. Whereas it typically takes weeks to analyze the results of a large-scale unsteady-flow simulation by use of steady-flow visualization software, the analysis time is reduced to hours when UFAT is used. UFAT can be used to generate graphical objects of flow visualization results using multi-block curvilinear grids in the format of a previously developed NASA data-visualization program, PLOT3D. These graphical objects can be rendered using FAST, another popular flow visualization software developed at NASA. Flow-visualization techniques that can be exploited by use of UFAT include time-dependent tracking of particles, detection of vortex cores, extractions of stream ribbons and surfaces, and tetrahedral decomposition for optimal particle tracking. Unique computational features of UFAT include capabilities for automatic (batch) processing, restart, memory mapping, and parallel processing. These capabilities significantly reduce analysis time and storage requirements, relative to those of prior flow-visualization software. UFAT can be executed on a variety of supercomputers.

*This program was written by David Kao of Ames Research Center and David Kenwright formerly of Computer Sciences Corp. Further information is contained in a TSP (see page 1).*

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## Software for Testing Electroactive Structural Components

A computer program generates a graphical user interface that, in combination with its other features, facilitates the acquisition and preprocessing of experimental data on the strain response, hysteresis, and power consumption of a multilayer composite-material structural component containing one or more built-in sensor(s) and/or actuator(s) based on piezoelectric materials. This program runs in conjunction with LabVIEW software in a computer-controlled instrumentation system. For a test, a specimen is instrumented with applied-voltage and current sensors and with

strain gauges. Once the computational connection to the test setup has been made via the LabVIEW software, this program causes the test instrumentation to step through specified configurations. If the user is satisfied with the test results as displayed by the software, the user activates an icon on a front-panel display, causing the raw current, voltage, and strain data to be digitized and saved. The data are also put into a spreadsheet and can be plotted on a graph. Graphical displays are saved in an image file for future reference. The program also computes and displays the power and the phase angle between voltage and current.

*This program was written by Robert W. Moses, Robert L. Fox, Archie D. Dimery, Robert G. Bryant, and Qamar Shams of Langley Research Center, and William C. White of Wyle Laboratories. Further information is contained in a TSP (see page 1). LAR-16546*

## Advanced Software for Analysis of High-Speed Rolling-Element Bearings

COBRA-AHS is a package of advanced software for analysis of rigid or flexible shaft systems supported by rolling-element bearings operating at high speeds under complex mechanical and thermal loads. These loads can include centrifugal and thermal loads generated by motions of bearing components. COBRA-AHS offers several improvements over prior commercial bearing-analysis programs: It includes innovative probabilistic fatigue-life-estimating software that provides for computation of three-dimensional stress fields and incorporates stress-based (in contradistinction to prior load-based) mathematical models of fatigue life. It interacts automatically with the ANSYS finite-element code to generate finite-element models for estimating distributions of temperature and temperature-induced changes in dimensions in iterative thermal/dimensional analyses: thus, for example, it can be used to predict changes in clearances and thermal lockup. COBRA-AHS provides an improved graphical user interface that facilitates the iterative cycle of analysis and design by providing analysis results quickly in graphical form, enabling the user to control interactive runs without leaving the program envi-