sion of polychromatic light, it would be possible to utilize broader wavelength ranges, maintain high transmissivity through use of wavelengths farther from the edges of the photonic bandgaps, take advantage of the reduction in nonlinearity to simplify the positioning of optical components, and take advantage of larger crystal spatial periods to further simplify fabrication. The design parameters that could be varied to obtain the desired properties include the angle of incidence, the angle of the exit surface, and the thicknesses of the layers.

One-dimensional photonic crystal superprisms for visible and infrared wavelengths could be fabricated on semiconductor wafers and, hence, could be integrated monolithically with other miniature optical components. In one example of this approach, a 1D photonic crystal superprism would be fabricated by patterning and anisotropic etching of one of two silicon layers of a silicon-on-insulator substrate (see Figure 2). In this case, the insulator (SiO_2) would not only provide structural support, because the index of refraction of SiO_2 is lower than that of Si, the SiO_2 layer would also act as an optical cladding layer to confine light to the 1D photonic crystal.

This work was done by David Z. Ting of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).
NPO-30594

Rapid Analysis of Mass Distribution of Radiation Shielding

Lyndon B. Johnson Space Center, Houston, Texas

Radiation Shielding Evaluation Toolset (RADSET) is a computer program that rapidly calculates the spatial distribution of mass of an arbitrary structure for use in ray-tracing analysis of the radiation-shielding properties of the structure. RADSET was written to be used in conjunction with unmodified commercial computer-aided design (CAD) software that provides access to data on the structure and generates selected three-dimensional-appearing views of the structure. RADSET obtains raw geometric, material, and mass data on the structure from the CAD software. From these data, RADSET calculates the distribution(s) of the masses of specific materials about any user-specified point(s). The results of these mass-distribution calculations are imported back into the CAD computing environment, wherein the radiation-shielding calculations are performed.

This program was written by Edward Zapp of Lockheed Martin Corp. for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-23935

Modeling Magnetic Properties in EZTB

NASA's Jet Propulsion Laboratory, Pasadena, California

A software module that calculates magnetic properties of a semiconducting material has been written for incorporation into, and execution within, the Easy (Modular) Tight-Binding (EZTB) software infrastructure. [EZTB is designed to model the electronic structures of semiconductor devices ranging from bulk semiconductors, to quantum wells, quantum wires, and quantum dots. EZTB implements an empirical tight-binding mathematical model of the underlying physics.]

This module can model the effect of a magnetic field applied along any direction and does not require any adjustment of model parameters. The module has thus far been applied to study the performances of silicon-based quantum computers in the presence of magnetic fields and of miscut angles in quantum wells. The module is expected to assist experimentalists in fabricating a spin qubit in a Si/SiGe quantum dot. This software can be executed in almost any Unix operating system, utilizes parallel computing, can be run as a Web-portal application program. The module has been validated by comparison of its predictions with experimental data available in the literature.

This program was written by Seungwon Lee and Paul von Allmen of Caltech for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-44782.

Deep Space Network Antenna Logic Controller

NASA's Jet Propulsion Laboratory, Pasadena, California

The Antenna Logic Controller (ALC) software controls and monitors the motion control equipment of the 4,000-metric-ton structure of the Deep Space Network 70-meter antenna. This program coordinates the control of 42 hydraulic pumps, while monitoring several interlocks for personnel and equipment safety. Remote operation of the ALC runs via the Antenna Monitor & Control (AMC) computer, which orchestrates the tracking functions of the entire antenna.

This software provides a graphical user interface for local control, monitoring, and identification of faults as well as, at a high level, providing for the digital control of the axis brakes so that the servo of the AMC may control the motion of the antenna. Specific functions of the ALC also include routines for startup in cold weather, controlled shutdown for both normal and fault situations, and pump switching on failure.

The increased monitoring, the ability to trend key performance characteristics, the improved fault detection and recovery, the centralization of all control at a single panel, and the simplification of the user interface have all reduced the required workforce to run 70-meter antennas. The ALC also increases the antenna availability by reducing the time required to start up the antenna, to diagnose faults, and by providing additional insight into the performance of key parameters that aid in preventive maintenance to avoid key element failure.

The ALC User Display (AUD) is a graphical user interface with hierarchical display structure, which provides high-level status information to the operation of the ALC, as well as detailed information for virtually all aspects of the ALC via drill-down displays. The operational status of an item, be it a function or assembly, is shown in the higher-level display. By pressing the item on the display screen, a new screen opens to show more detail of the function/assembly. Navigation tools and the map button allow immediate access to all screens.

This program was written by Harlow Ahlstrom, Scott Morgan, Peter Hames, Martha Strain, Christopher Owen, and Kenneth Shimizu of Caltech; Karen Wilson, David Shaller, and Said Doktormomtaz of Modern Technologies Corp.; and Patrick Leung of Northrop Grumman Corp. for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-44341.

Modeling Carbon and Hydrocarbon Molecular Structures in EZTB

NASA's Jet Propulsion Laboratory, Pasadena, California

A software module that models the electronic and mechanical aspects of hydrocarbon molecules and carbon molecular structures on the basis of first principles has been written for incorporation into, and execution within, the Easy (Modular) Tight-Binding (EZTB) software infrastructure, which is summarized briefly in the immediately preceding article. Of particular interest, this module can model carbon crystals and nanotubes characterized by various coordinates and containing defects, without need to adjust parameters of the physical model.

The module has been used to study the changes in electronic properties of carbon nanotubes, caused by bending of the nanotubes, for potential utility as the basis of a nonvolatile, electric-charge-free memory devices. For example, in one application of the module, it was found that an initially 50-nm-long carbon, (10,10)-chirality nanotube, which is a metallic conductor when straight, becomes a semiconductor with an energy gap of ≈3 meV when bent to a lateral displacement of 4 nm at the middle.

This program was written by Seungwon Lee and Paul von Allmen of Caltech for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-44781.

BigView Image Viewing on Tiled Displays

Ames Research Center, Moffett Field, California

BigView allows for interactive panning and zooming of images of arbitrary size on desktop PCs running Linux. Additionally, it can work in a multi-screen environment where multiple PCs cooperate to view a single, large image. Using this software, one can explore — on relatively modest machines — images such as the Mars Orbiter Camera mosaic [92,160×33,280 pixels].

The images must be first converted into "paged" format, where the image is stored in 256×256 "pages" to allow rapid movement of pixels into texture memory. The format contains an "image pyramid": a set of scaled versions of the original image. Each scaled image is 1/2 the size of the previous, starting with the original down to the smallest, which fits into a single 256×256 page.

This program was written by Timothy Sandstrom of Advanced Management Technology for Ames Research Center. For further information, access http://opensource.arc.nasa.gov/ or contact the Ames Technology Partnerships Division at (650) 604-2954. ARC-15277-1

Imaging Sensor Flight and Test Equipment Software

Marshall Space Flight Center, Alabama

The Lightning Imaging Sensor (LIS) is one of the components onboard the Tropical Rainfall Measuring Mission (TRMM) satellite, and was designed to detect and locate lightning over the tropics. The LIS flight code was developed to run on a single onboard digital signal processor, and has operated the LIS instrument since 1997 when the TRMM satellite was launched.

The software provides controller functions to the LIS Real-Time Event Processor (RTEP) and onboard heaters, collects the lightning event data from the RTEP, compresses and formats the data for downlink to the satellite, collects housekeeping data and formats the data for downlink to