Predicting Accumulations of Ice on Aerodynamic Surfaces

LEWICE is a computer program that predicts the accumulation of ice on two-dimensional aerodynamic surfaces under conditions representative of the flight of an aircraft through an icing cloud. The software first calculates the airflow surrounding the body of interest, then uses the airflow to compute the trajectories of water droplets that impinge on the surface of the body. The droplet trajectories are also used to compute impingement limits and local collection efficiencies, which are used in subsequent ice-growth calculations and are also useful for designing systems to protect against icing. Next, the software predicts the shape of accumulating ice by modeling transfers of mass and energy in small control volumes. The foregoing computations are repeated over several computational time steps until the total icing exposure time is reached. Results of computations by LEWICE have been compared with an extensive database of measured ice shapes obtained from experiments, and have been shown to closely approximate those shapes under most conditions of interest to the aviation community.

This program was written by Colin Bidwell, Mark Potapczuk, and Gene Addy of **Glenn Research Center** *and William Wright of QSS Group, Inc. Further information is contained in a TSP (see page 1).*

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Commercial Technology Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland Ohio 44135. Refer to LEW-17378.

Analyzing Aeroelasticity in Turbomachines

ASTROP2-LE is a computer program that predicts flutter and forced responses of blades, vanes, and other components of such turbomachines as fans, compressors, and turbines. ASTROP2-LE is based on the ASTROP2 program, developed previously for analysis of stability of turbomachinery components. In developing ASTROP2-LE, ASTROP2 was modified to include a capability for modeling forced responses. The program was also modified to add a capability for analysis of aeroelasticity with mistuning and unsteady aerodynamic solutions from another program, LINFLX2D, that solves the linearized Euler equations of unsteady two-dimensional flow. Using LINFLX2D to calculate unsteady aerodynamic loads, it is possible to analyze effects of transonic flow on flutter and forced response. ASTROP2-LE can be used to analyze subsonic, transonic, and supersonic aerodynamics and structural mistuning for rotors with blades of differing structural properties. It calculates the aerodynamic damping of a blade system operating in airflow so that stability can be assessed. The code also predicts the magnitudes and frequencies of the unsteady aerodynamic forces on the airfoils of a blade row from incoming wakes. This information can be used in high-cycle-fatigue analysis to predict the fatigue lives of the blades.

This program was written by O. Mehmed of **Glenn Research Center** *and T. S. R. Reddy and R. Srivastava of the University of Toledo. Further information is contained in a TSP (see page 1).*

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Commercial Technology Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland Ohio 44135. Refer to LEW-17477.

Software for Allocating Resources in the Deep Space Network

TIGRAS 2.0 is a computer program designed to satisfy a need for improved means for analyzing the tracking demands of interplanetary space-flight missions upon the set of ground antenna resources of the Deep Space Network (DSN) and for allocating those resources. Written in Microsoft Visual C++, TIGRAS 2.0 provides a single rich graphical analysis environment for use by diverse DSN personnel, by connecting to various data sources (relational databases or files) based on the stages of the analyses being performed. Notable among the algorithms implemented by TIGRAS 2.0 are a DSN antenna-load-forecasting algorithm and a conflict-aware DSN schedule-generating algorithm. Computers running TIGRAS 2.0 can also be connected using SOAP/XML to a Web services server that provides analysis services via the World Wide Web. TIGRAS 2.0 supports multiple windows and multiple panes in each window for users to view and use information, all in the same environment, to eliminate repeated switching among various application programs and Web pages. TIGRAS 2.0 enables the use of multiple windows for various requirements, trajectory-based time intervals during which spacecraft are viewable, ground resources, forecasts, and schedules. Each window includes a time navigation pane, a selection pane, a graphical display pane, a list pane, and a statistics pane.

This program was written by Yeou-Fang Wang, Chester Borden, Silvino Zendejas, and John Baldwin of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

This software is available for commercial licensing. Please contact Don Hart of the California Institute of Technology at (818) 393-3425. Refer to NPO-30856.

Expert Seeker

Expert Seeker is a computer program of the knowledge-management-system (KMS) type that falls within the category of expertise-locator systems. The main goal of the KMS system implemented by Expert Seeker is to organize and distribute knowledge of who are the domain experts within and without a given institution, company, or other organization. The intent in developing this KMS was to enable the re-use of organizational knowledge and provide a methodology for querying existing information (including structured, semistructured, and unstructured information) in a way that could help identify organizational experts. More specifically, Expert Seeker was developed to make it possible, by use of an intranet, to do any or all of the following:

- Assist an employee in identifying who has the skills needed for specific projects and to determine whether the experts so identified are available.
- Assist managers in identifying employees who may need training opportunities.
- Assist managers in determining what