This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-45056.

Trajectory Calculator for Finite-Radius Cutter on a Lathe

A computer program calculates the two-dimensional trajectory (radial vs. axial position) of a finite-radius-of-curvature cutting tool on a lathe so as to cut a workpiece to a piecewise-continuous, analytically defined surface of revolution. (In the original intended application, the tool is a diamond cutter, and the workpiece is made of a crystalline material and is to be formed into an optical resonator disk.) The program also calculates an optimum cutting speed as F/L, where F is a material-dependent empirical factor and L is the effective instantaneous length of the cutting edge.

The input to the program includes the analytical specification of each desired continuous piece of the surface. The output of the program corresponds to an approximate tool trajectory in the form of (1) a set of short straight-line segments connecting the precise trajectory points at user-defined axial steps and (2) the optimum cutting speed for each segment. The program includes algorithms for rounding corners, limiting the depth of cut, and making extra cutouts to prevent excessive stresses. The output of this program is read by a different program that controls stepping motors that move the cutting tool.

This program was written by Dmitry Strekalov, Anatoliy Savchenkov, and Nan Yu 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 Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-45086.

Integrated System Health Management Development Toolkit

This software toolkit is designed to model complex systems for the implementation of embedded Integrated System Health Management (ISHM) capability, which focuses on determining the condition (health) of every element in a complex system (detect anomalies, diagnose causes, and predict future anomalies), and to provide data, information, and knowledge (DIaK) to control systems for safe and effective operation.

An important functionality of ISHM is that DIaK is embedded and easily accessible. The software includes tools for distributed storage, evolution, and distribution of DIaK, and easy accessibility. For example, an intelligent sensor includes a TEDS (Transducer Electronic Data Sheet); processes for data validation and sensor health determination; communication capability to provide DIaK to other elements of the system; and to receive DIaK in order to improve its ability to validate its data and determine its own health.

The ISHM-Development Toolkit (ISHM-DTK) is an object-oriented environment that enables creation of a model of any complex system (or system-of-systems — SoS) for the ISHM embedded capability. SoS are defined as hierarchical networks of intelligent elements (sensors, components, controllers, processes, sub-systems, systems, etc.).

Integration is established by defining "Intelligent Processes" that represent models of processes that provide the means to check consistency of DIaK across the entire system. Multiple models of varying granularity and fidelity may represent a process, and they may be activated based on context. ISHM-DTK includes communications gateways to read data into the model.

ISHM-DTK allows for modular implementation of ISHM capability with almost total re-use of software. The toolkit also allows incremental implementation of ISHM capability where more and better DIaK is added as these become available or refined in the research and technology community. In order to accommodate legacy elements, such as classical sensors or components, intelligent elements may be virtually implemented in the software, or may use another software environment and/or computer in the network.

This work was done by Jorge Figueroa of Stennis Space Center and Harvey Smith and Jon Morris of Jacobs Technology.

Inquiries concerning this technology should be addressed to the Intellectual Property Manager, Stennis Space Center, (228) 688-1929. Refer to SSC-00255-1, volume and number of this NASA Tech Briefs *issue, and the page number.*