Software

GLobal Integrated Design Environment

John H. Glenn Research Center, Cleveland, Ohio

The GLobal Integrated Design Environment (GLIDE) is a collaborative engineering application built to resolve the design session issues of real-time passing of data between multiple discipline experts in a collaborative environment. Utilizing Web protocols and multiple programming languages, GLIDE allows engineers to use the applications to which they are accustomed — in this case, Excel — to send and receive datasets via the Internet to a database-driven Web server.

Traditionally, a collaborative design session consists of one or more engineers representing each discipline meeting together in a single location. The discipline leads exchange parameters and iterate through their respective processes to converge on an acceptable dataset. In cases in which the engineers are unable to meet, their parameters are passed via e-mail, telephone, facsimile, or even postal mail. The result of this slow process of data exchange would elongate a design session to weeks or even months. While the iterative process remains in place, software can now exchange parameters securely and efficiently, while at the same time allowing for much more information about a design session to be made available.

GLIDE is written in a compilation of several programming languages, including REALbasic, PHP, and Microsoft Visual Basic. GLIDE client installers are available to download for both Microsoft Windows and Macintosh systems. The GLIDE client software is compatible with Microsoft Excel 2000 or later on Windows systems, and with Microsoft Excel X or later on Macintosh systems.

GLIDE follows the Client-Server paradigm, transferring encrypted and compressed data via standard Web protocols. Currently, the engineers use Excel as a front end to the GLIDE Client, as many of their custom tools run in Excel.

SSC Engineering Analysis

Stennis Space Center, Mississippi

A package for the automation of the Engineering Analysis (EA) process at the Stennis Space Center has been customized. It provides the ability to assign and track analysis tasks electronically, and electronically route a task for approval. It now provides a mechanism to keep these analyses under configuration management. It also allows the analysis to be stored and linked to the engineering data that is needed to perform the analysis (drawings, etc.). PTC's (Parametric Technology Corporation) Windchill product was customized to allow the EA to be created, routed, and maintained under configuration management. Using Info-engine Tasks, JSP (JavaServer Pages), Javascript, a user interface was created within the Windchill product that allows users to create EAs. Not only does this interface allow users to create and track EAs, but it plugs directly into the out-of-the-box ability to associate these analyses with other relevant engineering data such as drawings. Also, using the Windchill workflow tool, the Design and Data Management System (DDMS) team created an electronic routing process based on the manual/informal approval process. The team also added the ability for users to notify and track notifications to individuals about the EA.

Prior to the Engineering Analysis creation, there was no electronic way of creating and tracking these analyses. There was also a feature that was added that would allow users to track/log e-mail notifications of the EA.

Automated Cryocooler Monitor and Control System Software

NASA's Jet Propulsion Laboratory, Pasadena, California

This software is used in an automated cryogenic control system developed to monitor and control the operation of small-scale crycoolers. The system was designed to automate the cryogenically cooled low-noise amplifier system described in "Automated Cryocooler Monitor and Control System" (NPO-47246), *NASA Tech Briefs*, Vol. 35, No. 5 (May 2011), page 7a.

The software contains algorithms necessary to convert non-linear output voltages from the cryogenic diode-type thermometers and vacuum pressure and helium pressure sensors, to temperature

and pressure units. The control function algorithms use the monitor data to control the cooler power, vacuum solenoid, vacuum pump, and electrical warm-up heaters. The control algorithms are based on a rule-based system that activates the required device based on the operating mode. The external interface is Web-based. It acts as a Web server, providing pages for monitor, control, and configuration. No client software from the external user is required.

✿ Common Bolted Joint Analysis Tool

Lyndon B. Johnson Space Center, Houston, Texas

Common Bolted Joint Analysis Tool (comBAT) is an Excel/VB-based bolted joint analysis/optimization program that lays out a systematic foundation for an inexperienced or seasoned analyst to determine fastener size, material, and assembly torque for a given design. Analysts are able to perform numerous "what-if" scenarios within minutes to arrive at an optimal solution. The program evaluates input design parameters, performs joint assembly checks, and steps through numerous calculations to arrive at several key margins of safety for each member in a joint. It also checks for joint gapping, provides fatigue calculations, and generates joint diagrams for a visual reference. Optimum fastener size and material, as well as correct torque, can then be provided.

Analysis methodology, equations, and guidelines are provided throughout the solution sequence so that this program does not become a "black box" for the analyst. There are built-in databases that reduce the legwork required by the analyst. Each step is clearly identified and results are provided in number format, as well as color-coded spelled-out words to draw user attention.

The three key features of the software are robust technical content, innovative and user friendly I/O, and a large database. The program addresses every aspect of bolted joint analysis and proves to be an instructional tool at the same time. It saves analysis time, has intelligent messaging features, and catches operator errors in real time.

✿ Draper Station Analysis Tool

Lyndon B. Johnson Space Center, Houston, Texas

Draper Station Analysis Tool (DSAT) is a computer program, built on commercially available software, for simulating and analyzing complex dynamic systems. Heretofore used in designing and verifying guidance, navigation, and control systems of the International Space Station, DSAT has a modular architecture that lends itself to modification for application to spacecraft or terrestrial systems. DSAT consists of user-interface, data-structures, simulation-generation, analysis, plotting, documentation, and help components. DSAT automates the construction of simulations and the process of analysis. DSAT provides a graphical user interface (GUI), plus a Web-enabled interface, similar to the GUI, that enables a remotely located user to gain access to the full capabilities of DSAT via the Internet and Web-browser software. Data structures are used to define the GUI, the Web-enabled interface, simulations, and analyses. Three data structures define the type of analysis to be performed: closed-loop simulation, frequency response, and/or stability margins. DSAT can be executed on almost any workstation, desktop, or laptop computer. DSAT provides better than an order of magnitude improvement in cost, schedule, and risk assessment for simulation based design and verification of complex dynamic systems.

✿ Commercial Modular Aero-Propulsion System Simulation 40k

John H. Glenn Research Center, Cleveland, Ohio

The Commercial Modular Aero-Propulsion System Simulation 40k (C-MAPSS40k) software package is a nonlinear dynamic simulation of a 40,000-pound (≈178-kN) thrust class commercial turbofan engine, written in the MATLAB/Simulink environment. The model has been tuned to capture the behavior of flight test data, and is capable of running at any point in the flight envelope [up to 40,000 ft (≈12,200 m) and Mach 0.8]. In addition to the open-loop engine, the simulation includes a controller whose architecture is representative of that found in industry.

The simulation environment gives the user easy access to health, control, and engine parameters. C-MAPSS40k has a graphical user interface (GUI) to allow users to easily specify an arbitrarily com-