Software

SynGenics Optimization System (SynOptSys)

The SynGenics Optimization System (SynOptSys) software application optimizes a product with respect to multiple, competing criteria using statistical Design of Experiments, Response-Surface Methodology, and the Desirability Optimization Methodology. The user is not required to be skilled in the underlying math; thus, SynOptSys can help designers and product developers overcome the barriers that prevent them from using powerful techniques to develop better products in a less costly manner. SynOptSys is applicable to the design of any product or process with multiple criteria to meet, and at least two factors that influence achievement of those criteria.

The user begins with a selected solution principle or system concept and a set of criteria that needs to be satisfied. The criteria may be expressed in terms of documented desirements or defined responses that the future system needs to achieve. Documented desirements can be imported into SynOptSys or created and documented directly within SynOptSys. Subsequent steps include identifying factors, specifying model order for each response, designing the experiment, running the experiment and gathering the data, analyzing the results, and determining the specifications for the optimized system. The user may also enter textual information as the project progresses. Data is easily edited within SynOptSys, and the software design enables full traceability within any step in the process, and facilitates reporting as needed.

SynOptSys is unique in the way responses are defined and the nuances of the goodness associated with changes in response values for each of the responses of interest. The Desirability Optimization Methodology provides the basis of this novel feature. Moreover, this is a complete, guided design and optimization process tool with embedded math that can remain invisible to the user. It is not a standalone statistical program; it is a design and optimization system.

This work was done by Carol Ventresca, Michelle L McMillan, and Stephanie Globus of SynGenics Corporation for Glenn Research Center. 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, Innovative Partnerships Office, Attn: Steven Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18924-1.

CFD Script for Rapid TPS Damage Assessment

This grid generation script creates unstructured CFD grids for rapid thermal protection system (TPS) damage aeroheating assessments. The existing manual solution is cumbersome, open to errors, and slow.

The invention takes a large-scale geometry grid and its large-scale CFD solution, and creates a unstructured "patch" grid that models the TPS damage. The flow field boundary condition for the "patch" grid is then interpolated from the large-scale CFD solution. It speeds up the generation of CFD grids and solutions in the modeling of TPS damages and their aeroheating assessment. This process was successfully utilized during STS-134.

This work was done by Peter McCloud of The Boeing Company for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809. MSC-24865-1

radEq Add-On Module for CFD Solver Loci-CHEM

The radEq software module allows Loci-CHEM to be applied to flow velocities where surface radiation due to heating from compression and friction becomes significant. The module adds a radiation equilibrium boundary condition to the computational fluid dynamics (CFD) code to produce accurate results. The module expanded the upper limit for accurate CFD solutions of Loci-CHEM from Mach 4 to Mach 10 based on Space Shuttle Orbiter Re-Entry trajectories.

Loci-CHEM already has a very promising architecture and performance, but absence of radiation equilibrium boundary condition limited the application of Loci-CHEM to below Mach 4. The immediate advantage of the add-on module is that it allows Loci-CHEM to work with supersonic flows up to Mach 10. This transformed Loci-CHEM from a rocket engine-heritage CFD code with general subsonic and low-supersonic applications, to an aeroheating code with hypersonic applications. The follow-on advantage of the module is that it is a building block for additional add-on modules that will solve for the heating generated at Mach numbers higher than 10.

This work was done by Peter McCloud of The Boeing Company. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809.

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act {42 U.S.C. 2457(f)} to The Boeing Company. Inquiries concerning licenses for its commercial development should be addressed to:

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Refer to MSC-24848-1, volume and number of this NASA Tech Briefs *issue, and the page number.*

Science Opportunity Analyzer (SOA) Version 8

SOA allows scientists to plan spacecraft observations. It facilitates the identification of geometrically interesting times in a spacecraft's orbit that a user can use to plan observations or instrument-driven spacecraft maneuvers. These observations can then be visualized multiple ways in both two- and three-dimensional views. When observations have been optimized within a spacecraft's flight rules, the resulting plans can be output for use by other JPL uplink tools. Now in its eighth major version, SOA improves on these capabilities in a modern and integrated fashion.

SOA consists of five major functions: Opportunity Search, Visualization, Observation Design, Constraint Checking, and Data Output. Opportunity Search is a GUI-driven interface to existing search engines that can be used to identify times when a spacecraft is in a specific geometrical relationship with other bodies in the solar system. This function can be used for advanced mission planning as well as for making last-minute adjustments to mission sequences in response to trajectory modifications. Visualization is a key aspect of SOA. The user can view observation opportunities in either a 3D representation or as a 2D map projection.