Cross Support Transfer Service (CSTS) Framework Library

Within the Consultative Committee for Space Data Systems (CCSDS), there is an effort to standardize data transfer between ground stations and control centers. CCSDS plans to publish a collection of transfer services that will each address the transfer of a particular type of data (e.g., tracking data). These services will be called Cross Support Transfer Services (CSTSSs). All of these services will make use of a common foundation that is called the CSTS Framework. This library implements the User side of the CSTS Framework. “User side” means that the library performs the role that is typically expected of the control center.

This library was developed in support of the Goddard Data Standards program. This technology could be applicable for control centers, and possibly for use in control center simulators needed to test ground station capabilities. The main advantages of this implementation are its flexibility and simplicity. It provides the framework capabilities, while allowing the library user to provide a wrapper that adapts the library to any particular environment.

The main purpose of this implementation was to support the interoperability testing required by CCSDS. In addition, it is likely that the implementation will be useful within the Goddard mission community (for use in control centers).

This work was done by Nancy Puckett, Kris Pettinger, John Hallstrom, Dana Brownfield, Eric Binn, Frank Williams, Kelli Wust, Steve McCarty, Daniel Ramirez, Nicole Lamotte, and Tuan Vu of United Space Alliance for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809. MSC-24958-1

Arbitrary Shape Deformation in CFD Design

Sculptr® is a commercially available software tool, based on an Arbitrary Shape Design (ASD), which allows the user to perform shape optimization for computational fluid dynamics (CFD) design. The developed software tool provides important advances in the state-of-the-art of automatic CFD shape deformations and optimization software. CFD is an analysis tool that is used by engineering designers to help gain a greater understanding of the fluid flow phenomena involved in the components being designed. The next step in the engineering design process is to then modify the design to improve the components’ performance. This step has traditionally been performed manually via trial and error. Two major problems that have, in the past, hindered the development of an automated CFD shape optimization are (1) inadequate shape parameterization algorithms, and (2) inadequate algorithms for CFD grid modification.

The ASD that has been developed as part of the Sculptr® software tool is a major advancement in solving these two issues. First, the ASD allows the CFD designer to freely create his own shape parameters, thereby eliminating the restrictions of only being able to use the CAD model parameters. Then, the software performs a smooth volumetric deformation, which eliminates the extremely costly process of having to remesh the grid for every shape change (which is how this process had previously been achieved). Sculptr® can be used to optimize shapes for aerodynamic and structural design of spacecraft, aircraft, watercraft, ducts, and other objects that affect and are affected by flows of fluids and heat. Sculptr® makes it possible to perform, in real time, a design change that would manually take hours or days if remeshing was needed.

This program was written by Mark Landan and Ernest Perry of Optimal Solutions Software, LLC for Stennis Space Center. For more information, contact Optimal Solutions at 208-521-4660. Refer to SSC-00290.