

## Applications Using the Unified Data Model

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The Unified Data Model (UDM) library was developed under the Advanced Simulation and Computing (ASC) program at Los Alamos National Laboratory to provide a high-performance parallel in/out (I/O) library for managing mesh connectivity and mesh data for simulation projects. The library includes a simple C application programming interface (API) that developers use to easily construct structured and unstructured meshes and their associated variables. The Unified Data Model supports multidimensional arrays and structured and unstructured meshes. Unstructured meshes can be constructed using fixed shapes or arbitrary polygons and polyhedrons. All mesh data are stored in a single file for easy file management, and the data file is platform-independent. The UDM library has been successfully integrated with the EnSight visualization tool [1] and the Shavano project [2].

### Integration with EnSight

Visualization software is an essential tool for analyzing meshes and mesh data. EnSight, a parallel visualization software developed by CEI, is the software commonly used at the Laboratory. It becomes a requirement with our customers that the mesh data written to files must be viewable in EnSight.

Part of the UDM distribution includes a shared library module that provides a plug-in for EnSight visualization. With the module, users are able to use EnSight to view a mesh and its variables that are stored in a UDM file. The plug-in supports 2-D and 3-D meshes.

EnSight provides a feature for handling distributed data, called server of servers (SoS). However, with earlier versions of EnSight, users were required to decompose an unstructured mesh manually or attempt to decompose the mesh using an unsupported partitioner. Consequently, they would have to decompose each time they used the server-of-servers (SoS) mode with a different number of servers. Since UDM stores mesh data in a single file, there is no partitioning required to view UDM data using the SoS mode.

### Integration with Shavano

The Shavano project is one of a number of ASC projects whose goal is to develop high-fidelity weapons simulations. The UDM library has been successfully integrated within the Shavano project to provide the ability to perform a parallel dump to a single file for restarting calculations. We added the ability to dump data to a UDM file for visualizing with EnSight. We are continuing our efforts to enhance data analysis using EnSight by including additional variable data.

We also demonstrated the ability to connect a legacy application to Shavano. We wrote output data from the legacy application to a UDM file, which was then imported into the Shavano project. Using the UDM format permitted the user to run calculations using the imported data with any number of CPUs. With the current process of running calculations, a user would need to generate a new set of files to run the same calculation with a different number

of CPUs. We are using UDM to eliminate this step by adding the capability to run with any number of CPUs using the same set of files. Figures 1 and 2 are 3-D simulations generated using UDM.

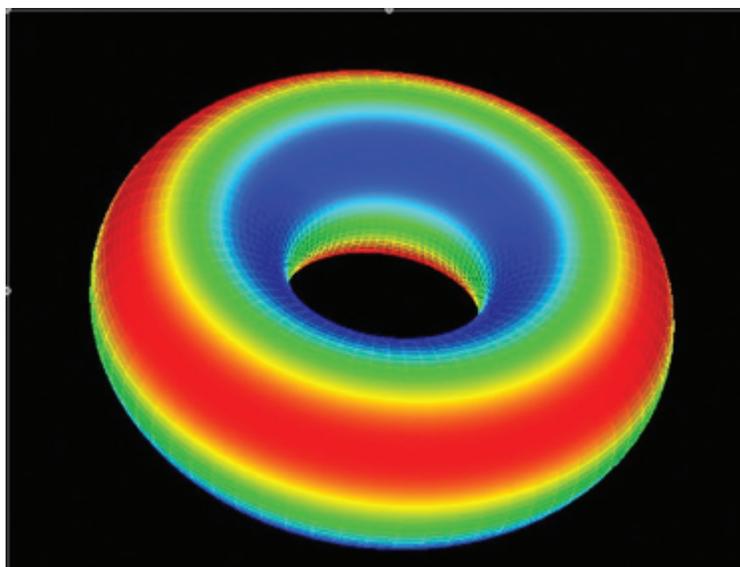
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[1] EnSight Web site, <http://www.ensight.com>.

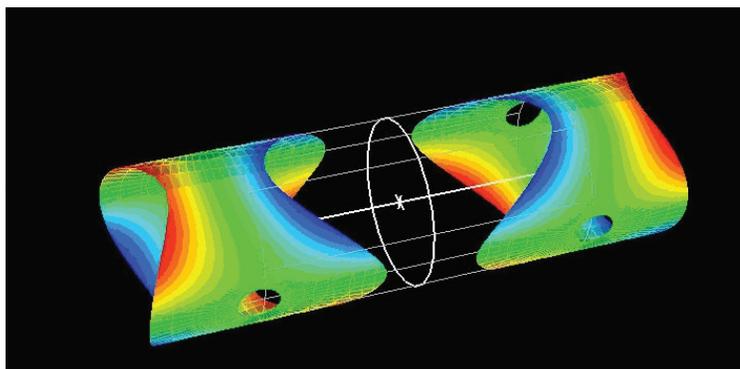
[2] K. Roark, "Classified colloquium to explore the future of weapon simulation," LANL News Bulletin, [http://int.lanl.gov/news/index.php/fuseaction/nb.story/story\\_id/7520/nb\\_date/2005-11-16](http://int.lanl.gov/news/index.php/fuseaction/nb.story/story_id/7520/nb_date/2005-11-16).

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**Fig. 1.**  
*Torus generated using UDM.*



**Fig. 2.**  
*Intersection of torus with a cylinder.*