

Meshing, visualization, and computational environments

There was probably no higher profile application of meshing, visualization, and computational software this past year than that performed in support of the space shuttle's Return to Flight activities. After heavy use of simulation during the accident investigation, these same tools are now helping address safety and operational issues. In turn, these applications are raising the bar for computational tools in terms of simulation fidelity and turnaround time.

Development and implementation of standards for data exchange and the integration of software applications continues to be a major focus of organizations in the computational simulation field. The Unstructured Grid Consortium (UGC, www.aiaa.org/tc/mvce/ugc/), an informal group of academic, government, and industry organizations, continued to advance the goal of meshing software interoperability through the development of version 2 of its application programmer interface (API). Development and demonstration of this ANSI-C API was completed this year by Pointwise, with funding from the U.S. Air Force Research Laboratory. The API's plug-in capability allows compliant applications to link dynamically with multiple compliant libraries and facilitates the introduction and sharing of new meshing technologies.

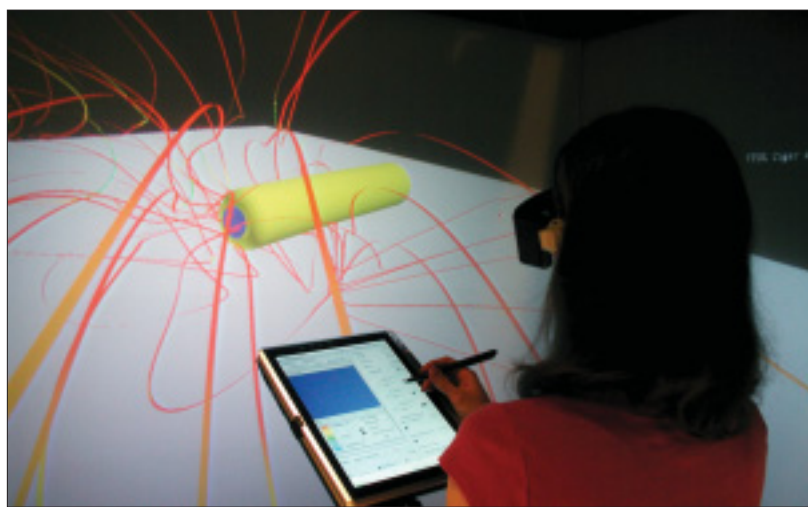
The international consortium CFD General Notation System (CGNS, www.cgns.org) released version 2.3 of the open-source software that provides a file transfer and archival mechanism for CFD and other computational data. CGNS is currently under review for adoption as an AIAA Recommended Practice. The process of establishing CGNS as an ISO standard (AP 237, Fluid Dynamics Data) continues.

With standards development as a high-profile activity, as evidenced by the activities of UGC and CGNS, the issue of standards compliance and certification remains open. Test suites and software reviews are only two of the techniques that must be addressed with respect to standards certification.

If commercialization is an indicator of maturity, immersive or virtual reality tools for computational environments are now mainstream. Computational Engineering International and ACUITIV have both provided immersive solutions for some time. The recent introduction of Intelligent Light's VR product helps bring CFD productivity to large-scale, immersive virtual reality facilities.

Engineers work on a single dataset and move directly between their desktop and multi-processor, parallel systems driving their display. A wireless tablet PC or desktop system can be used within the environment to access all of the software's functionality. No longer is substantial setup time, transfer to new applications, or re-training required. These immersive tools bring the workflow advances developed over decades on the desktop to scalable, immersive visualization environments.

Development of software tools for optimizing and directing computational simulations in the design environment is another area of activ-



Immersive environments, like this one from Intelligent Light, are becoming mainstream tools for extracting engineering knowledge from computational simulations.

ity. A wide suite of tools is available from Engineous Software, FE-DESIGN, ESTECO, and others. A leading firm in this area, Engineous, recently acquired Synaps, developers of optimization software that is focused on the aerospace market.

The year 2004 saw the emergence of two computing platforms for computational desktop usage. Apple's Power Mac G5 provides a 64-bit multiprocessor environment with a Unix-based operating system, facilitating porting computational software that historically comes from a Unix background. Desktop PCs based on the AMD Opteron CPU provide both 64-bit computing and the ability to run 32-bit legacy applications natively without performance degradation.

As the capabilities of computational simulations have grown and the accuracy of computational simulations have improved, the size and fidelity of simulations has increased. Most application developers, commercial and otherwise, have already ported or have announced plans to port their software to 64-bit environments in order to exceed the 2-GB-memory barrier imposed by 32-bit applications. ▲

by John R. Chawner