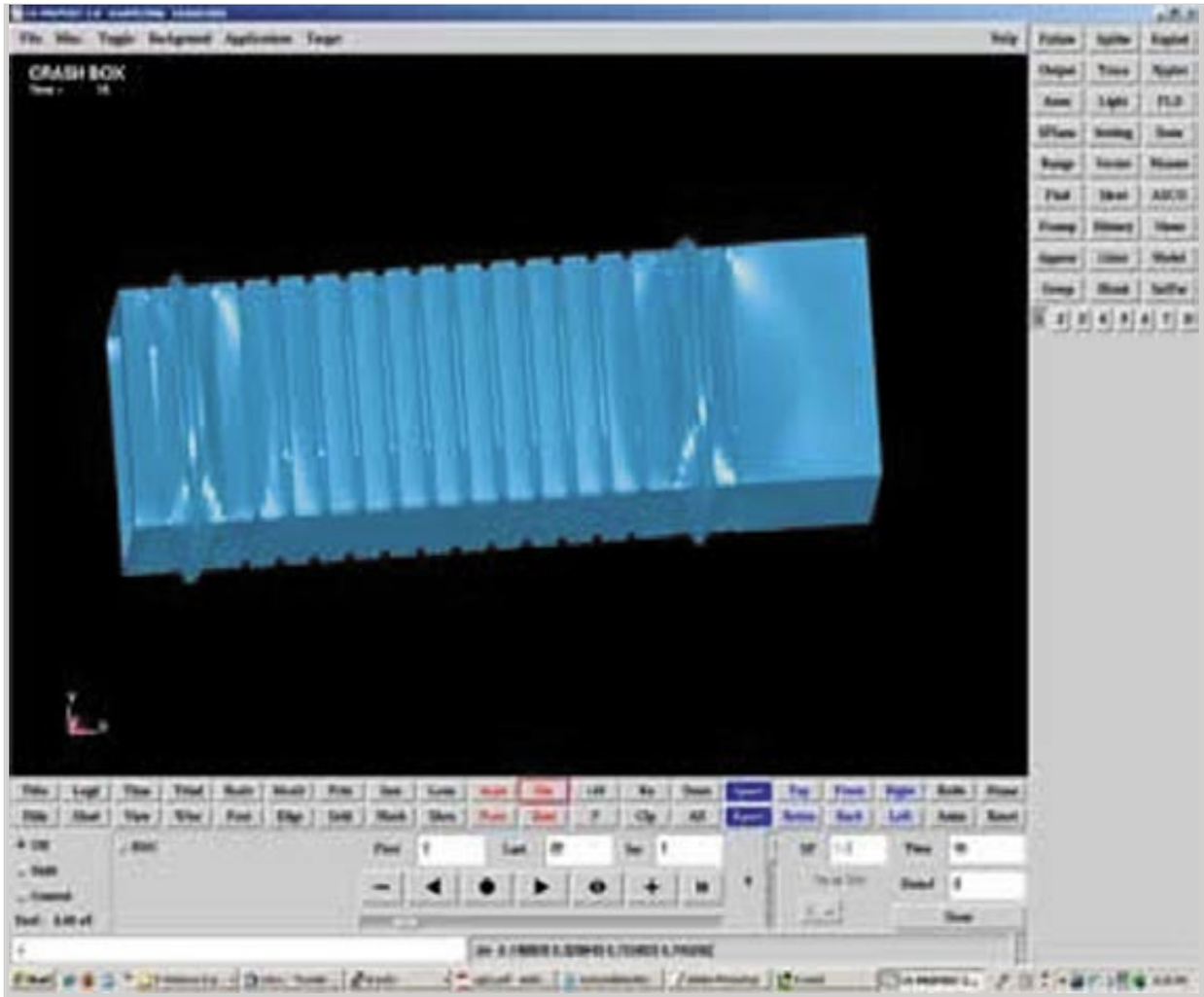

Multi-disciplinary Optimisation (MDO) is a design method becoming increasingly popular in the automotive industry. MDO is the process by which an engineering model, such as a model of vehicle test crash performance, vehicle stiffness, mass or even fluid dynamics, is optimised with respect to more than one discipline, for example, more than one discipline of physics, or entirely different disciplines such as physics and chemistry. To do this with today's desktop computing power, it is necessary to pre-compute results for a large number of parameterised models, which is not only a time-consuming process but leads to a huge amount of output data. High Performance Computing (HPC) is, therefore, a necessity for MDO. The application of HPC to MDO allows design engineers to analyse more model variants under more test conditions with far less manual intervention. In turn, this significantly increases engineers' productivity and allows for a better, safer vehicle design.

<<< 3D Virtual Engineering Demonstrator

Application of MDO in Structural Engineering

VPAC provides Virtual Engineering (VE) services to engineering clients and develops and promotes the use of Virtual Integrated Design Environments, with the aim of revolutionising the Australian automotive industry by improving automobile product design and manufacturing processes and increasing the industry's environmental sustainability. At the core of VPAC's VE capability is its expertise in enterprise level MDO. VPAC has comprehensive capability, software tools, services, and infrastructure for construction and execution of multidisciplinary optimisation. To show that a 3D virtual engineering environment allows engineers to effectively interact with structural engineering models and the large amounts of output data that arise from MDO, VPAC developed a demonstrator where the user can interact with structural engineering models and perform MDO on those models in a 3D interactive environment. To build this demonstrator a framework for representing and interacting with objects in a 3D user interface was developed using a games engine.

Building a 3D Virtual Engineering Demonstrator

To build the 3D Virtual Engineering Demonstrator, VPAC:

- Designed the framework for the 3D interactive environment (how the software menus and environment function).
- Created the final framework and demonstrator for the 3D interactive environment in Virtools (game engine).
- Integrated the demonstrator with the VPAC designed 3D user input device NaviSphere. NaviSphere has the specific ability to allow for intuitive navigation through complex design environments. The device allows a user to access 6-dimensional (3 translational dimensions and 3 rotational dimensions) control within a 3D Virtual Integrated Design Environment.
  Integrated the demonstrator with GridAustralia, a computational grid portal that provides Australian researchers with seamless access to the combined computational, data and visualisation resources of the participating HPC facilities around Australia. Integrating the 3D demonstrator with the grid portal allows MDO to take place in the virtual environment. Without this integration, MDO would be impossible to execute because of the huge amount of computational power required for a single MDO job. Integration with the grid portal also ensures users on-line access to scientific instruments, dynamic interaction with large-scale distributed data sets, and advanced collaboration activities such as computational steering through video conferencing systems like the Access Grid.
- Tested the demonstrator and associated framework.

Easy and Efficient Interaction with Engineering Models

VPAC's 3D Virtual Engineering Demonstrator allows engineers to easily and effectively interact with engineering models, submit MDO jobs based on those models and view the output of the MDO jobs in an effective format (for example, output movies).

The 3D Virtual Engineering Demonstrator can not only be applied to structural engineering, but to any discipline where the user interacts with 3D models or with such a large amount of data that 3D interactivity with that data would be beneficial. This could be anybody from engineers to financial analysts and economists. With the increasing prevalence of computational analysis in many disciplines, the potential applications of demonstrator are varied and wide.

Further Information

For further information, please contact Chris Seeling at chs@vpac.org or phone +61 3 9647 5433 or visit www.vpac.org.

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