DOE's Oak Ridge National Laboratory Develops a Model for an Aluminum Intensive Vehicle

Background Information

This project's objective was to develop a detailed Finite Element model of a representative Aluminum-intensive vehicle using computational modeling and simulations. The developed model can be used as a simulation platform for evaluation and prediction of structural effects of advanced manufacturing and materials processing techniques in automotive in-service conditions. (Figure 1).

Figure 1. Finite Element Model of an aluminum intensive vehicle

Project Payoffs/Benefits

A verified simulation model allows for component, material and other design modifications. The model provides a low-cost modeling environment for testing new design and processing technologies without the need for building expensive prototypes. The model can be used for structural applications such as crashworthiness and stiffness analysis.

Significant Accomplishments

- The all-Aluminum Audi A8 was disassembled and its structural components were scanned.
- The model includes complex sub-components for crash energy management (Figure 2).

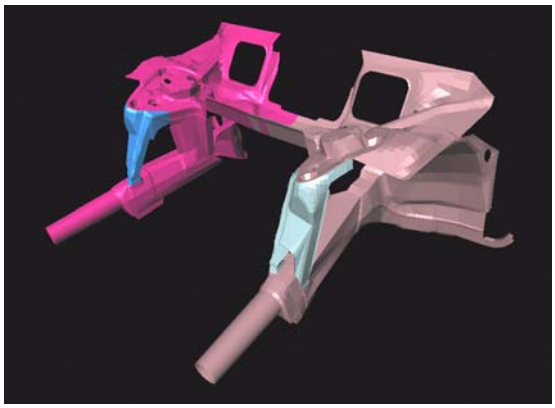

Figure 2. Model of the frontal impact energy absorption structure.

- The model contains approximately 300000 finite elements and 200 different material components.
- The crash test experiment was performed by the National Highway Traffic Safety Administration. The test results were used for model tuning and verification (Figure 3).

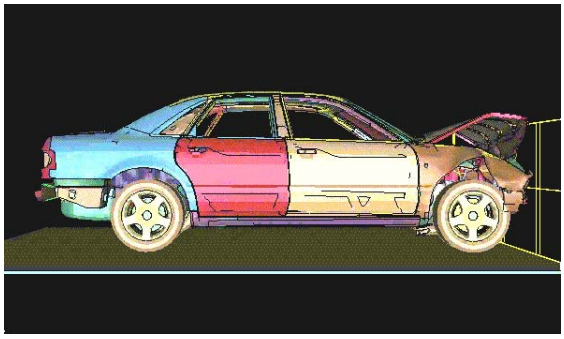

Figure 3. Crash Simulation of vehicle impact into a rigid frontal barrier

- The deformation of the developed model was verified against the crash test data.
- The model development was done on massively parallel computers at the ORNL Center for Computational Sciences.

Program Manager: Joseph Carpenter
Phone: (202) 586-1022; Fax: 202 586-7409;
Email: Joseph.Carpenter@ee.doe.gov