9732 Study of Deformation Behavior of Lightweight Steel Structures Under Impact Loading

Benefits

- Provides tools that can be used for evaluation of the deformation behavior of lightweight steel structures under impact loading.
- Evaluates steel processing technologies and identification of areas of design improvement.
- Minimizes of the number of physical structures that need to be built to improve design concepts, thus saving manufacturers time and money.
- Establishes the competitive advantage of steel by demonstrating the advantages of lightweight steel designs.
- Enables lightweight steel auto structures from this study to save .37 quad of energy by the year 2020.

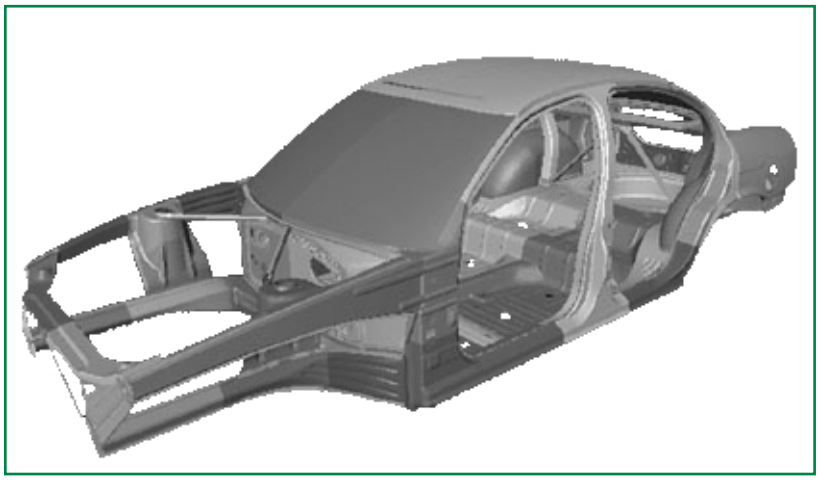
Applications

The models, analytical techniques and tools resulting from this study will allow comparison of the deformation behavior of lightweight steel structures with the structures in existing fleet cars and with structures incorporating alternative materials. It will also be possible to incorporate different material processing technologies and some design modifications and evaluate their deformation performance. Use of these tools could accelerate the development of lightweight steel auto bodies.

Study will provide tools to evaluate the deformation behavior of lightweight steel structures under impact loading

Oak Ridge National Laboratory (ORNL), in conjunction with the American Iron and Steel Institute (AISI) and its partners, is using computational modeling to develop tools to analyze the deformation behavior of lightweight steel vehicles.

The next generation of vehicles will have to be significantly lighter in order to meet the fuel efficiency requirements. The real challenge of reducing vehicular weight is to maintain and improve performance compared to current designs while ensuring safety standards and affordability. Alternative materials must overcome obstacles such as cost, ease of manufacture and applications, and durability, before they can become a viable alternative to steel. An alternate approach is to use improved steels and advanced steel forming technologies coupled with innovative designs, such as done by the UltraLight Steel Auto Body-Advanced Vehicle Concepts program. The models and analytical techniques developed will provide a comprehensive tool that the steel industry and its partners can use to improve designs for lightweight steel vehicles.



An alternative approach to lightweight vehicle design uses advanced steel processing and design technologies.

Project Description

Goal: To develop computational tools that will accelerate the development and introduction of lightweight steel automotive structures by using advanced computational simulations to assess integrated design and performance under impact loading conditions.

Initial activities will evaluate the modeling capabilities of ORNL with information from the Ultra Lightweight Steel Auto Body-Porsche study. Other Phase 1 activities will focus on establishing a partnership that will define a set of parameters to be analyzed to assess and demonstrate the advantages of lightweight steel designs.

The second phase of the project will perform detailed computational analysis of the situations defined in Phase 1. These situations will involve existing ultra lightweight steel and other auto body designs. The project's final stage is to document developments and findings in a manner that will allow for simple modification and analysis.

Progress and Milestones

- Already completed are the establishment of a partnership, determination of the ULSAB designs to be modeled and analyzed, and the impact scenarios to be used.
- Crash models have been analyzed and verified with crash results.
- ULSAB documentation is being analyzed to develop a materials and process database for parts processing simulation activities.
- Project completed on January 8, 2001.

Total Project Cost/Duration

$872,000/three years.

Research Organization

Oak Ridge National Laboratory
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Industry Participants

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