Physical and Virtual Test Machine for Automotive Crashworthiness

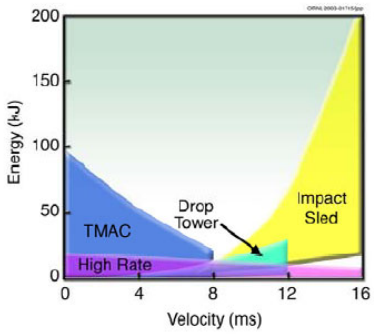
The Oak Ridge National Laboratory and the Automotive Composites Consortium of the United States Council for Automotive Research collaborated in creating the world's first integrated virtual and physical test system for high-force, high-rate crashworthiness experiments of automotive materials and structures. This unique system, the Test Machine for Automotive Crashworthiness (TMAC), permits controlled, progressive crush experiments at programmable velocity profiles and high force levels. It will provide strain-rate sensitivity data heretofore unavailable to automotive researchers and designers. It was designed, engineered, and manufactured by MTS Systems, Inc., of Minneapolis, Minnesota.

Intended Use

The TMAC will provide dynamic data for automotive crashworthiness analyses. It is applicable to any structural material (metal, polymer, composite, glazing, and so forth) and is available through the National Transportation Research Center (a U.S. Department of Energy National User Facility) to all automotive safety stakeholders including domestic and foreign automotive original equipment manufacturers and their suppliers, universities, and government laboratories.

Benefits

The principal significance of TMAC is that it will provide unique strain-rate sensitivity data for automotive materials employed in crash energy management applications. Specifically, the data will be used to improve dynamic material models and crash analysis methods. These advancements will result in more efficient design processes and more robust designs with respect to crashworthiness.



Features

- Highest dynamic force, 267 kN (60 kip), hydraulic system known to exist for controlled physical testing of materials and structures at impact velocities greater than 8 m/s (18 mph).
- Only known hydraulic system that incorporates a large mass, 450 kg (1000 lbs), to mitigate experimental issues related to force spikes and crush force fluctuations.
- Only known system that can maintain controlled velocity profiles at intermediate rates (1 to 5 m/s) and high force levels.
- Provides an integrated virtual and physical experimental capability that permits the system to learn and tune itself prior to the test, minimizing consumption of expensive test articles.

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