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SIMULATION OF A CRASH-BOX FOR RACING CAR BASED ON SANDWICH MATERIAL

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ABSTRACT

Some of the more important design considerations for vehicle crashworthiness are energy absorption maximization, weight reduction and manufacturability. The energy absorption capability of an exposed crashworthy component is greatly affected by its structural design and material properties. Recently, a tendency for constructing sandwich structures seems to be of great importance for crashworthiness problems because offers a unique combination of properties such as low density, high stiffness, strength and energy absorption capability. The front crash-box is the most important component for energy dissipation during frontal crash. It must dissipate most of the kinetic energy of the vehicle in a rather stable, controlled and uniform crushing process.

The present paper deals with the implementation of the explicit FE code LS-DYNA to simulate the crash behaviour and energy absorption characteristics of a thin-walled crash-box for a racing car (Fig.1) made of sandwich material subjected to a frontal impact of 12 m/s.

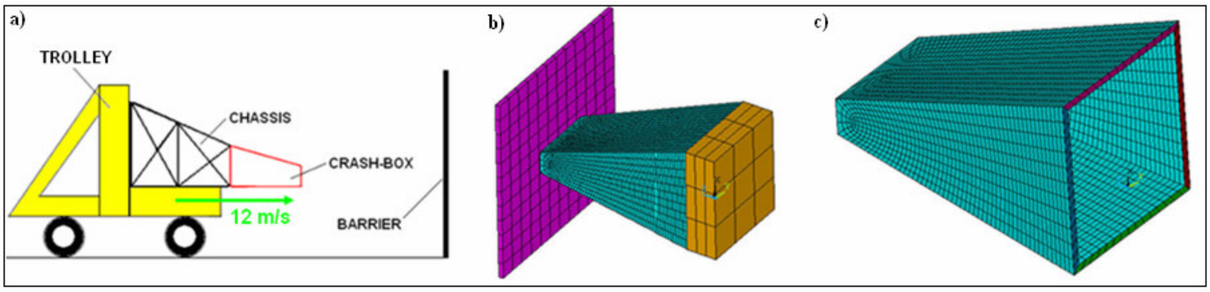

Fig. 1. Dynamic test: a) Experimental, b) Numerical, c) Crash-box

The panels are composed by two skin in aluminium alloy and an aluminium honeycomb core with hexagonal cells. Different approaches for modelling sandwich structures by the FE method exist, which differ in modelling, computational cost and results accuracy. The adoption of these structures depends on the specific model size and loading case. In this work the three-dimensional modelling approach was adopted, with solid elements for the core and shell elements for the face sheets. To determine the parameters for the orthotropic honeycomb material model it was conducted a virtual model testing, that is a combination between numerical and experimental tests.
The obtained results are compared with available experimental data from real models in terms of deformation modes, energy absorption capability, load/deflection history and crush zone characteristics, showing good agreement.

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