On The Effects of an Additive Manufactured Hybrid Shock Absorbers on the Crashworthiness of a Small Electric Minibus.

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Abstract.

Increasing the impact resistance properties of any transport vehicle is an real engineering challenge. The aim of the work presented in this paper is to address this challenge by proposing an high-performing structural solution. Actually, by means of numerical crash simulations, this paper assesses the performance, in terms of energy absorbing characteristics improvement and peak accelerations reduction, of highly-efficient shock absorbers integrated in a minibus chassis key positions.

The high efficiency of the proposed damping system has been achieved by improving the current design and manufacturing process of the shock absorbers state-of-the-art. Indeed, the proposed passive safety system is composed of Additive manufactured hybrid polymer/composite (Polypropylene/Composite Fibers Reinforced Polymers) shock absorbers. The combination of this two different materials offers the possibility to merge the composites high stiffness-to-mass and strength-to-mass ratios with the capability to dissipate energy by plastic deformation of PP. Moreover, thanks to the additive manufacturing technique, it is possible to design and manufacture low mass and low volume highly efficient shock-absorbing sandwich structures.

By comparing the stress state and force-time diagrams, resulting from the numerical crash simulations on the proposed chassis configurations (with and without the proposed shock absorber system), this paper demonstrates the severe reduction in the stress state and the gradual damping in acceleration peaks achieved with the proposed design solution.