VEHICLE STRUCTURE RESPONSE COMPARISON BETWEEN STEEL AND COMPOSITE BRACKETS/REINFORCEMENTS – A PRELIMINARY FINITE ELEMENT ANALYSIS STUDY

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ABSTRACT

New regulations and complex crash safety requirements expect each automobile manufacturer to develop safer product. In addition, concerns related to environment protection and a goal of providing better/increased fuel economy auto industries are looking towards materials which are light weight and at the same time do not compromise safety requirements.

The current preliminary finite element analysis (FEA) was undertaken to compare the vehicle structure response between steel and composite brackets/reinforcements. A baseline FE a model of a sedan with steel reinforcement/brackets was adapted and as a next step the material of all the brackets/reinforcements was changed to composite. A set of four different types of composites (Carbon Thermoset Braided Composite, E-Glass Epoxy, CFS003, and CFRP) were evaluated.

The FE models were simulated in a frontal crash modes and vehicle response parameters such as rocker acceleration, dynamic dash intrusion and crush were monitored and compared between the five (baseline steel + four composite) models.

It was observed that total mass of the reinforcements/brackets was reduced by an average 65-70% when replaced with composites. Also, the vehicle response comparison between the baseline and composite reinforcement/brackets iterations revealed an inverse linear relationship

between acceleration and crush. Interesting observations in terms of energy absorption characteristics were observed between the steel and composite reinforcement/brackets.

The present preliminary study highlights usage of composites in vehicle structure as a first step towards mass reduction. However, current study was conducted by only material substitution ignoring the attachment between composite and other steel structures. Future studies are required in order to optimize a composite structure model in order to design a robust vehicle structure comprising of combination of composites and other metal materials.