

Crashworthiness performance of green composite energy absorbing structure with embedded sensing device providing cleaner environment for sustainable maintenance

Abstract

In this study, bio-degradable green composite energy absorbing structure with embedded self-sensing device is proposed as a viable alternative to the conventional synthetic ones without sensing device. The goal of the study is to introduce the promising potentials of integrating a low-cost self-sensing device into green composite energy absorbing structure so as to achieve green high performance capabilities. At first, a comparative analysis of the mechanical strength of green composites and their synthetic counterparts is given according to results obtained from previous works. It is shown that by mixing appropriate amount of reinforcing agents with green composites, the mechanical strength is improved significantly and the reinforced green composite material can, therefore, be used to fabricate highly efficient energy absorbers for crashworthiness application. In the latter part of the study, a self-sensing device, made from carbon nanotubes, collects information and tracks the performance of the green energy absorbing structure as well as its extent to environmental friendliness, is proposed. Finally, the synergistic role of the green composite energy absorber with the embedded self-sensing device is presented. The result of the proposed structure promises higher green performance capabilities over their conventional natural and synthetic counterparts without sensing device. It is found that the overall green performance capabilities resulted in increased crashworthiness performance, improved fuel economy, better environmental friendliness, efficient sustainable maintenance and the enhancement of human lives.

Keywords: Crashworthiness performance; Green composites; Carbon nanotubes; Self-sensing device; Sustainable maintenance.