

Lightweight design of vehicle structure with tailor rolled blank under crashworthiness

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Abstract

Unlike existing uniform thickness structures, tailor rolled blank (TRB) which allows continuous metal thickness changes has been recently gaining comprehensive attention due to its excellent lightweight potential. The aim of this study is to combine the advantages of the TRB manufacturing technology with the structural optimization methodology to design the front longitudinal beam under impact load. First, a simplified frontal impact FE model was extracted from the full vehicle finite element model and experimentally verified. Then, the conventional uniform thickness inner panel was replaced with the TRB. Finally, the ε -SVR surrogate with artificial bee colony (ABC) algorithm was used to obtain the optimal thickness distribution of TRB. The results show that weight of TRB front longitudinal beam was reduced by 16.10%, while the crashworthiness was significantly improved.

Keywords: Tailor rolled blank (TRB); Front longitudinal beam (FLB); Crashworthiness optimization; Lightweight design