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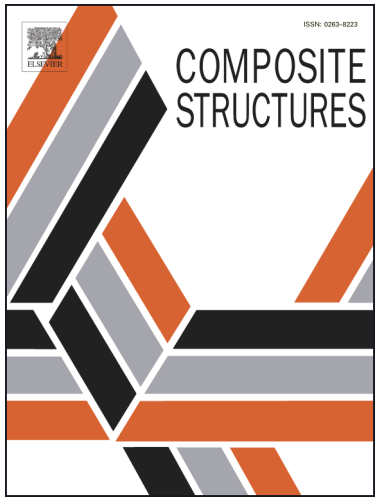

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A multi-hierarchical successive optimization method for reduction of spring–back in autoclave forming

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Abstract

In this study, a novel multi-hierarchical successive optimization method is proposed to reduce the spring-back in autoclave forming. Compared with other popular engineering optimization method, the proposed method decomposes the original problem in to several sub-problems according to the global sensitivity index. The optimization should be completed for each sub-problem successively according to the order of global sensitivity index (GSIs) of all sub-problems. To guarantee the feasibility of the final optimized solution, three popular heuristic global optimization methods are integrated with the least square support vector regression. Moreover, the accuracy of finite element evaluation is another key issue for the optimization. To obtain the high accurate result, four user subroutines, UMAT, USDFLD, HETVAL and UEXPAN, are used in the simulation of the autoclave forming process in ABAQUS. Furthermore, the simulation results show that the predictions agree well with each other and that they give good predictions compared to the experimental results of autoclave forming process.

Keywords

Autoclave forming, spring-back, multi-hierarchical successive optimization, global sensitivity analysis, least square support vector regression

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