Multidisciplinary optimization of auto-body lightweight design using modified particle swarm optimizer

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Abstract

Rising complexity of the automotive industry results in enormously increasing of disciplines. It becomes highly important to find the best compromise among these disciplines in the automotive design process. The coupling strategy among different disciplines and the algorithms employed to solve optimization problems are two core aspects defined by the architecture of multidisciplinary design optimization (MDO). In this paper, a MDO architecture is investigated to decide the best compromise among multiple working conditions (frontal impact, frontal offset impact, lateral impact, rear impact, auto-body stiffness and mode cases) with respect to auto-body lightweight design. Since the selection of optimization algorithms has a significant influence on the optimization time and the final solution, particle swarm optimization (PSO) algorithm is modified and promoted to accommodate different load cases. The established MDO architecture is applied to a lightweight design application of an auto-body, and the results verify its effectiveness and validity.

Keywords: Multidisciplinary design optimization; Particle swarm optimization; Collaborative optimization; Auto-body lightweight design; Kriging modeling technique.