Sensitivity and Optimization of Responses from Nonlinear Analyses

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Abstract

Engineering structures exhibit nonlinear behavior frequently during regular operations. Nonlinearities can be broadly classified into three main categories – 1. Status change from loading (Ex: Contact between surfaces), 2. Large deflection or deformation of the structure (Ex: Landing gear deflection) and 3. Nonlinear material behavior (Ex: Vehicle powertrain components such as gaskets undergo elasto-plastic or hyper-elastic or plastic deformations). Such nonlinearities could occur in isolation or in combination of each other. Hence, nonlinear analyses have become an integral and essential part of engineering simulation. It is also important and inevitable that nonlinear criteria be considered during the design of engineering structures.

In this paper, the formulation of the sensitivity calculation for nonlinear analysis and nonlinear responses implemented within the commercial software Altair Optistruct will be presented. Several design studies will also be included covering shape, sizing and topology optimization for different types of nonlinearities.