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Seismic Design Procedures in the Framework of Evolutionary Based Structural Optimization

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ABSTRACT

Since the early seventies structural optimization has been the subject of intensive research and several different approaches have been advocated for the optimal design of structures in terms of optimization methods or problem formulation. Most of the attention of the engineering community has been directed towards the optimum design of structures under static loading conditions with the assumption of linear elastic structural behaviour. For a large number of real-life structural problems assuming linear response and ignoring the dynamic characteristics of the seismic action during the design phase may lead to structural configurations highly vulnerable to future earthquakes. Furthermore, seismic design codes suggest that under severe earthquake events the structures should be designed to deform inelastically due to the large intensity inertia loads imposed.

The objective of this work is to evaluate various design procedures adopted by seismic codes and their influence on the performance of real-scale structures under an objective framework provided by structural optimization. Several studies have appeared in the literature where seismic design procedures based on non-linear response (e.g. [1,2]) are presented and compared. However, this task can be accomplished in a complete and elaborate manner only in the framework of structural optimization, where the designs obtained with different procedures can be directly evaluated by comparing the value of the objective function of the optimization problem and the seismic performance of the optimum solution achieved. In this work evolutionary methods are implemented [3-5] to address the optimization problem and replace the conventional trial and trial and adjustment-based procedures.

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