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OPTIMUM DESIGN OF ACTIVELY CONTROLLED STRUCTURES USING COOPERATIVE GAME AND STACKELBERG GAME THEORY

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ABSTRACT

This paper presents an approach for the optimum design of actively controlled structures using a multi-level, multi-objective optimization method to simultaneously address both structural and control design aspects. Structural weight, controlled system energy, controller induced dissipation energy and fast damping time are some of the important objectives to be considered for the integrated design of structural and control systems. A simple approach for dealing with multiple objectives is to convert them to one objective using a weighted combination of objective functions. But in case of a large number of objectives or when the objective functions are not equally important and a hierarchical structure exists, then the problem cannot be solved by the conventional weighted combination approach and therefore multi-level optimization techniques are required. This paper presents a multi-level, multi-objective method for design of actively controlled structures with mixed discrete-continuous variables using a game theory formulation. In particular, the optimization problem is modelled as a cooperative and Stackelberg game. It is assumed that the structural and control objective functions are present at different levels and the exchange of information between the two levels is based on variable updating using response surface methods. It is seen that proposed approach is able to successfully design a controller which brings the structure back to its equilibrium position quickly under the influence of an external disturbance.

KEYWORDS: *Cooperative Game, Multi-level Optimization, Stackelberg Game, Vibration Control*

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