FRACTIONAL-ORDER PD CONTROL DESIGN FOR ACTIVE VIBRATION CONTROL OF SMART STRUCTURES

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Abstract

Smart structures are obtained by integration of actuators, sensors and controllers into conventional structures and they play an important role in the field of active vibration control, especially in aerospace engineering. Certain elements of a smart structure possess viscoelastic properties which can be modeled by using fractional calculus. The fractional-order model of a smart structure implies the necessity of using fractional order controllers instead of integer order controllers. This paper deals with design of the fractional-order proportional-derivative (PD) controller with robust stability and disturbance rejection. The transfer function of the fractional-order PD controller is parameterized, and these parameters are found by using of the Particle swarm optimization method minimizing a cost function related to the H_∞ norm. The fractional-order model of the smart structure is found by experimental identification by using the frequency response method. In order to represent the efficiency of the proposed controller, obtained results are compared with the corresponding results in the case when an integer-order PD controller is applied.

Keywords

Smart structures, Active vibration control, Fractional calculus, H_∞ control.

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