

Interval Type-2 Fuzzy Vibration Control of an ERF Embedded Smart Structure

Authors : Chih-Jer Lin, Chun-Ying Lee, Ying Liu, Chiang-Ho Cheng

Abstract : The main objective of this article is to present the semi-active vibration control using an electro-rheological fluid embedded sandwich structure for a cantilever beam. ER fluid is a smart material, which cause the suspended particles polarize and connect each other to form chain. The stiffness and damping coefficients of the ER fluid can be changed in 10 micro seconds; therefore, ERF is suitable to become the material embedded in the tunable vibration absorber to become a smart absorber. For the ERF smart material embedded structure, the fuzzy control law depends on the experimental expert database and the proposed self-tuning strategy. The electric field is controlled by a CRIO embedded system to implement the real application. This study investigates the different performances using the Type-1 fuzzy and interval Type-2 fuzzy controllers. The Interval type-2 fuzzy control is used to improve the modeling uncertainties for this ERF embedded shock absorber. The self-tuning vibration controllers using Type-1 and Interval Type-2 fuzzy law are implemented to the shock absorber system. Based on the resulting performance, Interval Type-2 fuzzy is better than the traditional Type-1 fuzzy control for this vibration control system.

Keywords : electro-rheological fluid, semi-active vibration control, shock absorber, type 2 fuzzy control

Conference Title : ICMAME 2014 : International Conference on Mechanical, Automotive and Materials Engineering

Conference Location : Prague, Czechia

Conference Dates : July 10-11, 2014