

An adaptive tuned vibration absorber containing an electromagnet with an adaptive synthetic shunt impedance is described. The system is designed to self-tune to retain optimal tuning under the presence of changes in excitation frequency, the properties of the host structure or environmental conditions. The control system comprises both feedforward (FF) and feedback (FB) elements. The FF controller is model based and adapts both the shunt resistance and capacitance. It is designed and implemented to provide a controllable effective mechanical stiffness and damping. The FB controller compensates for errors in model parameters, estimates of the excitation frequency or environmental changes. Three different FB algorithms are implemented and tested, namely linear, nonlinear polynomial, and fuzzy logic control. Experimental results show that the linear controller is unreliable, but the polynomial and fuzzy controllers work effectively. The adaptive controller can successfully adapt the system to track a variable excitation frequency while being robust to errors or changes in system parameters and provides guaranteed stability in operation.