Vibration Control of Nonlinear Rotor Systems Using Dynamic Absorber

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Keywords: Passive control, Nonlinear Vibration, Dynamic absorber, Optimal design

Abstract

In the rotating machinery, because the unbalance is inevitable, the resonance occurs if the rotational speed is in the vicinity of the major critical speed. When a rotor system is supported by single-row deep groove ball bearings, nonlinear spring characteristics appear due to clearance of bearings. In such rotor systems, the vibration characteristics change due to the effect of nonlinearities.

In this paper, we studied passive vibration control of nonlinear rotor systems by using a dynamic absorber. By the theoretical analysis, we clarified that the nonlinearity influences on the vibration characteristics of controlled rotor systems. As the example, we showed that, if the rotor system has an isotropic symmetrical nonlinearity, we can not use fixed points theorem for the optimization of the dynamic absorber, because the vibration increases due to the effect of this nonlinearity.

We also investigate the parameter optimization of the dynamic absorber taking into consideration the effects of nonlinearity. We applied the Newton-Rapthon method numerically to design the optimal parameters of dynamic absorber and clarified that the vibration control can be achieved by considering nonlinearities in designing the dynamic absorber.

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