

Dynamic Analysis of High Speed Spindle System with Diametrical and Thrust Magnetic Bearings

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ABSTRACT

This paper presents dynamic analysis of high-speed spindle system with diametrical and thrust magnetic bearings. The spindle is modeled as dual rotors including both outer and inner flexible shafts. The outer shaft supported by front, rear and thrust magnetic bearings is composed of the spindle shaft and the rotor of AC motor. And the inner shaft is the tool holder. The dynamic behavior of the dual rotor system is modeled by the finite element method (FEM) and the system natural frequencies, mode shapes and steady-state response are determined by the numerical analysis. System instability occurs when the spindle is subjected to dynamic lateral loading as well as dynamic axial loading during the machining process. The Floquet theory is applied to investigate stability of the spindle system.

Keywords: High-speed spindle; Magnetic bearings; Dual rotor; Floquet theory; Finite element method