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Transient dynamical analysis of a dual-rotor system excited by a sudden loss of mass of blade

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Abstract

The transient dynamics of a high speed rotor assembly of a gas turbine is presented in this paper demonstrates that the blade loss will significantly influence to the rotor. To theoretically investigate the motion stability of the system, a reduced rigid Jeffcott rotor model with symmetrical short bearings is presented. The equations of motion are derived considering the nonlinear lubricant forces of bearings. The transient response of the rotor is numerically obtained through the Runge-Kutta scheme with adaptable step-sizes. It is shown that the equilibrium of the rotor is disturbed due to the sudden loss of mass. However, the stability of motion can be restored. Bifurcation diagrams are constructed to investigate the responses of the rotor at various the rotation speeds at a specific eccentricity. The largest Lyapunov exponent (LLE) diagram has been presented to indicate when the system evolves into chaos.

Keywords: blade loss; Jeffcott rotor; largest Lyapunov exponent