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Saturation Phenomenon in Two-mode Non-linear Vibrations of the Rotor in a Magneto-hydrodynamic Field

Abstract: 2-DOF nonlinear dynamics of the rotor supported on the magneto-hydrodynamic bearing is investigated using the perturbation analysis. The two modes corresponding to the vertical and horizontal vibrations of the rotor are coupled. The nonresonant case and the various resonant cases (with and without an internal resonance) are considered. The frequency-response curves are obtained. When the amplitude of the external harmonic excitation is near to one of the natural frequency of the vibrations and the system is in conditions of an internal resonance, a saturation phenomenon occurs. When the amplitude of the external excitation increases, after some critical value the energy pumping between various sub-motions of the rotor occurs for each mode. Further, the influence of hysteretic dissipation on the amplitude level of the rotor vibrations is investigated.