NONLINEAR DYNAMICS OF JEFFCOTT ROTORS WITH AIR EXCITING VIBRATION FORCE

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Abstract. This paper studies nonlinear dynamic characteristics of Jeffcott rotors with air exciting vibration force generated by the impeller blade tip clearance of eccentric and seal clearance force. Firstly, a direct integral method is applied to calculate the system parameters. Then, combined with the computational results, phase diagram, axis path and poincare maps, nonlinear dynamics of the rotor under different rotor speeds and blade tip clearance force will be analyzed. The obtained results show that the rotor system experiences periodic-like motion and period-doubling motion transformation during the process to chaos when the blade tip clearance force and the rotary speed increase. Finally, numerical simulations are presented to illustrate the obtained results.

Keywords. Jeffcott rotor; blade tip clearance force; sealing force; nonlinear system; chaos.

AMS (MOS) subject classification: 70K50, 93C10, 65P20

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