CONTRIBUTION OF BEARING STRUCTURE IN GAS TURBINE POWER UNIT ROTOR DYNAMICS

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ABSTRACT

A contribution of journal bearings structural characteristics in rotor dynamics of stationary gas turbine power unit is considered. An influence of fluid film bearings with smooth surfaces and foil gas bearings to high-speed rotor dynamic characteristics is investigated. On analysis of low-speed rotor dynamic behavior a contribution of tilting pad hydrodynamic bearings and multilobe hydrodynamic bearings is considered.

The methodology for calculation of bearing carrying force, stiffness and damping coefficients for various bearing structures is developed. This methodology is taking into account gap changing caused both by bearing components and shaft journal surfaces microdeformations and by macrodeformations and possible tilting of bearing components. Microdeformations of shaft journal and bearing working surfaces are calculated on the basis of solution of the elastohydrodynamic contact problem for bearings with smooth surfaces, tilting pad bearings and multilobe bearings. Macrodeformations for gas bearing foil segments are determined by calculation of interaction of shaft journal, foil segments, bearing case and gas lubrication in bearing. Tilting pads position in journal bearing is founded from condition of equilibrium for all loads forced on each pad from the direction of lubrication film and shaft journal.

The calculation of high-speed and low-speed rotor trajectories of motion is carried out. Eigenvalues are determined and evaluation of rotor motion trajectories stability is carried out for regimes of rotor stationary revolving under considering of stiffness and damping dynamic coefficients in bearings.

Keywords: rotor dynamics of gas turbine power unit, tilting pad bearing, foil gas bearing, multilobe bearing, elastohydrodynamic contact problem