Dynamic Behavior of High-speed Rotor Supported by Fluid Film Journal Bearings

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ABSTRACT

Dynamic behavior of high-speed multisupported rotor in fluid film bearings is considered. Finite element model of rotor takes into account nonlinearity of supports. Stiffness of every support is defined by superposition of case stiffness and fluid film stiffness. To define parameters of case stiffness 3D FE modeling is applied. It is shown that radial and tangent stiffnesses of fluid film are nonlinear functions of journal's eccentricity ratio. These functions follow from solution of the Reynolds' equation. Stiffness values are defined by an iterative procedure. Action of large centrifugal loads on some parts of high-speed rotor brings an increase in rotor disbalances and respectively an increase in supports's reactions and stiffnesses. This effect is included in rotor's dynamic analysis. Reactions at rotor’s supports, natural frequencies and mode shapes of a centrifugal compressor are investigated in the whole range of rotor speeds.

Keywords: high-speed rotor, fluid film journal bearing, Reynolds equation, rotor’s static and dynamic behavior