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Titel des Beitrags: Analysis of the Experimental and CFD-Based Theoretical Methods for Studying Rotordynamic Characteristics of Labyrinth Gas Seals

Abstract: This paper presents an analysis of the experimental and theoretical methods used to study rotordynamic characteristics of short staggered labyrinth gas seal. Two experimental identification procedures referred to as static and dynamic methods are presented. The static method allows determining direct and cross-coupled stiffness coefficients of the seal by integrating measured circumferential pressure distribution in cavities at various shaft eccentric positions. In the dynamic method, identification of stiffness and damping coefficients is based on the rotor excitation using a magnetic actuator and utilizes the effect of alternation of rotor vibrations due to aerodynamic forces acting in the seal. The experimental results obtained by the static and dynamic methods demonstrate an apparent discrepancy most of all in the direct stiffness coefficients. A CFD-based model of the seal is used to predict rotordynamic coefficients and to analyze the discrepancies between the static and dynamic measurements. The seal forces are calculated in two ways similar to the experimental procedures. The predictions are in good agreement with experimental results obtained by both measurement techniques. The effects of pressure differential, inlet swirl, shaft rotational speed, shaft eccentricity, and inflow cavity on
Seal stiffness and damping are presented. The discrepancies between different methods must be kept in mind while studying rotordynamic characteristics of seals.