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Investigation on the dynamic response of aerostatic bearings-rotor system with different bearing gas

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Aerostatic bearings, due to their low friction and long lifespan, are widely used in high speed cryogenic turbo expanders. In various refrigeration cycles, it is essential for the bearing gas to be compatible with the working fluid gas to prevent contamination of the whole process. Due to variations in bearing gas viscosity, density and other properties, the static and dynamic characteristics of bearings differ. In this study, the fluid-structure coupled model of the bearing-rotor system is established, then the transient Reynolds equation and rotor motion equation are solved by finite difference method and direct integration method synchronously, the nonlinear dynamic response of the system is obtained. Ultimately, the study analyzes the effects of different bearing gases on dynamic characteristics, indicating that low-viscosity gases can improve system stability, which offers valuable guidance for optimizing the performance of bearing-rotor systems.

Submitters Country

China

Author: Dr QIU, Shun (Technical institute of physics and Chemistry,CAS)

Co-authors: Dr KE, Changlei (Technical institute of physics and Chemistry,CAS); LIU, Hongmin (Technical institute of physics and Chemistry,CAS); Dr LI, Kongrong; Prof. LIU, Liqiang (Technical institute of physics and Chemistry,CAS); Prof. PENG, Nan (Technical institute of physics and Chemistry,CAS); Dr ZHANG, Xiaohua (Technical institute of physics and Chemistry,CAS)

Presenter: Prof. LIU, Liqiang (Technical institute of physics and Chemistry,CAS)

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