자기베어링 시스템을 가진기로 이용한 스퀴즈 필름 댐퍼의 동강성 계수 규명

김근주† (한국과학기술원 기계공학과) · 이종원*(한국과학기술원 기계공학과)

Identification of Dynamic Stiffness of Squeeze Film Damper using Active Magnetic Bearing System as an Exciter

Keun-Joo Kim and Chong-Won Lee

Key Words : Squeeze Film Damper (스퀴즈 필름 댐퍼), Dynamic Stiffness (동강성), Active Magnetic Bearing System (능동 자기베어링), Central Feeding Groove (중앙 이송홈)

Abstract : In this work, the dynamic characteristics of an oil-lubricated, short SFD with a central feeding groove are derived based on a theoretical analysis considering the effect of a groove. The validity of the analysis is investigated experimentally using an Active Magnetic Bearing (AMB) system as an exciter. For the theoretical solution, the fluid film forces of a grooved SFD are analytically derived so that the dynamic coefficients of a SFD are expressed in terms of its design parameters. For the experimental validation of the analysis, a test rig using AMB as an exciter is proposed to identify the dynamic characteristics of a short SFD with a central groove. As an exciter, the AMB represents a mechatronic device to levitate and position the test journal without any mechanical contact, to generate relative motions of the journal inside the tested SFD and to measure the generated displacements during experiments with fairly high accuracy. Using this test rig, experiments are extensively conducted with different clearance, which is one of the most important design parameters, in order to investigate its effect on the dynamic characteristics and the performance of SFDs. Damping and inertia coefficients of the SFD that are experimentally identified are compared with the analytical results to demonstrate the effectiveness of the analysis method. It is also shown that AMB is an ideal device for tests of SFDs.

자기베어링의 Fault Tolerance 제어

나언주(발표자, 한국기계연구원)

Fault Tolerant Control of Magnetic Bearings

Uhn Joo Na

Key Words : Fault Tolerance, Magnetic Bearings, Rotordynamics

Abstract : Fault tolerant control algorithm for heteropolar magnetic bearings are presented. This fault tolerant control utilizes grouping of currents as C-cores in order to isolate magnetic fluxes. Hardware requirements to maintain fault tolerant control are reduced since decoupling chokes are not required in this control scheme. The currents supplied to each pole are redistributed, if some coils fail suddenly, such that the resultant magnetic forces should remain invariant through coil failure events. Load capacity before magnetic saturation is reduced through coil failures while maintaining the same magnetic forces before and after failure.