A novel continuously adjustable hydrodynamic bearing

Conference or Workshop Item

A novel form of adjustable fluid film bearing has been devised whereby the hydrodynamic conditions can be changed in a continuously controlled manner during operation. The principle can be applied to conventionally orientated journal bearings, i.e. a shaft rotating within a stationary bearing housing; to inverse orientations, i.e. a rotor on a stationary shaft; and to thrust bearings.

A theoretical model and computerised solution technique were developed in which the fluid film profile, temperature, viscosity and pressure fields were simultaneously solved.

Experiments were conducted on journal bearing versions for which recently developed measurement techniques demonstrated stable operation at zero eccentricity, and the ability to move the rotational centre whilst in operation.

Performance characteristics predicted by the computer model have been demonstrated in practice. The novel bearing has shown significant improvements over conventional designs in tems of stiffness, damping, rotational accuracy, power losses and temperature rise.

Attributes	**Benefit**
Reduced power absorbed	Saves energy; very important in large diameter and/or high speed bearings.
Improved stability	Operation at lower load/higher speed combinations possible. Reduced rotor vibration.
Reduced lubricant temperature rise	Higher rotational speeds possible for a given maximum temperature. Conversely maximum temperature in lubricant reduced for a given operating condition.
Increased stiffness	Reduced vibration due to unbalanced forces. Higher critical speeds.
Adjustable whilst rotating for:	
❒ Stiffness and damping	Obtain optimum performance over wide speed range. Change rotor critical speeds whilst rotating and thereby improve ability to pass through critical speeds without damage caused by vibration.
❒ Journal centre location	Precision applications. Maintaining a specified centre of rotation (incl. zero eccentricity) for a range of loads and speeds.
❒ Wear	Maintain characteristics over a longer period.
❒ ΔT variation	Higher rotational speeds. Reduced thermal effects.