Controllable sliding bearings and controllable lubrication principles—an overview

Hydrodynamic and aerodynamic lubrication regimes in their controllable forms have been intensively investigated over the last two decades. With the aim of reducing friction and improving thermal, static, and dynamic characteristics of radial sliding bearings, different types of electro-mechanical actuators have been coupled to such bearings. Depending on (i) the actuator type; (ii) the actuation principle, i.e., hydraulic, pneumatic, piezoelectric or magnetic among others; and (iii) how such an actuator is coupled to the sliding bearings, different regulation and control actions of fluid film pressure and lubricant flow can be obtained. The most common actions are: (a) the control of the injection pressure to modify the fluid film pressure statically as well as dynamically; (b) the adjustment of the angle and direction of injection flow (mostly passive action); (c) the control of the sliding bearing gap and its preload via moveable and compliant sliding surfaces; and (d) the control of the lubricant viscosity. All four parameters, i.e., pressure, flow (velocity profiles), gap and viscosity, are explicit parameters in the modified form of Reynolds’ equations for active lubrication. In this framework, this paper gives one main original contribution to the state-of-the-art of radial sliding bearings and controllable lubrication: a comprehensive overview about the different types of controllable sliding bearings and principles used by several authors. The paper ends with some conclusive remarks about advantages and drawbacks of the different design solutions for controllable sliding bearings and the main challenges to be overcome towards industrial applications.

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