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Editorial

Friction and Lubrication of Sliding Bearings

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Bearings are essential components of machines, as they provide the low friction and energy consumption required for motion. The development of bearing technologies has focused on increasing efficiency, reducing friction, improving durability, simplifying maintenance and installation, and making bearings more suitable for different environments. As a result, various types of bearings have been developed, including ball and roller bearings, aerostatic bearings for clean environments, and hydrostatic bearings for high damping and reduced vibration.

This Special Issue presents the latest research on bearing operating behaviors, measurement techniques, and designs and applications. Nosov et al. [1] analyzed the contact deformation of spherical bearing elements through a modified polytetrafluoroethylene (PTFE) layer with different lubricant recess geometries for anti-friction. Their findings indicate that spherical lubricant recesses have several advantages, such as more uniform contact parameters in interface areas and a reduction in the maximum level of plastic deformation intensity.

Adamov et al. [2] analyzed the deformation behavior of a spherical bearing with various locations and inclination angles of the antifriction layer. They found that changing the inclination angle of the antifriction layer end face had a significant effect on the maximum level of contact parameters and deformation characteristics. Kang [3] investigated the nonlinear oscillations induced by friction in a ball-in-socket system. Theoretical analyses showed that the friction noise of a ball joint can retain periodic, quasi-periodic, or chaotic oscillations with respect to tilted contact.

Tang and Li [4] experimentally studied the friction and wear mechanisms of nano-lubricated, high-speed rolling bearings in various nanoparticle embedded states. The results show that the complete embedded state of nanoparticles effectively improves the anti-wear effect of the bearing. Adamov et al. [5] performed contact deformation analysis of spherical bearing elements at a high nominal vertical load. They considered several types of spherical sliding layer materials and observed a decrease in the maximum level of contact parameters with an increase in the sliding layer thickness. The influence of anti-friction layer materials on bearing deformation becomes insignificant with an increase in the spherical sliding layer thickness.

Wen et al. [6] installed a measurement system on a test rig to capture images of the lubricants in bearings, providing information on lubricant volume and distribution. This approach offers a tool that may be used to look inside bearings and provide further knowledge of the structure and lubrication design of ball bearings. Hagemann et al. [7] investigated a two-lobe offset-halves type of bearing specially designed to reduce frictional power loss. In this design, part of the bearing sliding surface is substituted with free areas to provide negligible friction in its boundary layers, resulting in a 37.2% improvement of frictional power loss for the test bearing.

Lin et al. [8] proposed a dual-membrane restrictor design to improve the stiffness performance of the compensated hydrostatic bearing. They derived theoretical models for the proposed dual-membrane restrictors and found that the membrane stiffness in the inlet restrictor was the most dominant parameter for the performance of the compensated

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bearing system. Huang and Yang [9] focused on a large-sized, capillary-compensated, constant-pressure hydrostatic rotary table used for a horizontal boring machine and used software to simulate the thermal and structural deformation of the worktable under eccentric loads. The results showed that a dual-ring hydrostatic-thrust-bearing layout resulted in lower worktable deformation than a single-ring layout with a larger recess diameter, but a larger recess diameter resulted in greater thermal deformation in a single-ring hydrostatic bearing pad layout.

Overall, this Special Issue provides insight into the latest research aiming to improve our understanding of bearing operating behaviors, measurement techniques, and designs and applications. The findings of these studies have the potential to inform the development of more efficient, durable, and suitable bearings for a range of applications.

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