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Editorial

Friction and Wear in Machine Design

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Tribology has been and will continue to be one of the most significant subjects due to its prevalence in practically every part of our lives. Friction is a primary cause of energy dissipation in many fields, from automotive to biomedical applications. The development of new energy technologies is one of the biggest global concerns of the 21st century because of substantial energy production and consumption issues. Understanding tribology allows us to find solutions to current and future technical challenges. As a result, research on reducing frictional power losses has received much attention due to it being a promising direction for improving the performance of various engineering applications. Recently, nanotechnology has led to the creation of novel materials for lubrication in tribological applications. Nanolubricants and self-lubricating materials have attracted enormous interest from manufacturers and researchers around the world in regard to enhancing the durability and lifespan of mechanical components. The main aim of this current Special Issue is to further develop tribological studies to reduce frictional power losses in various mechanical applications, enhancing the durability of the tribo-components and saving energy. This Special Issue (SI) will present the latest research on friction, wear, and lubrication in different mechanical applications. We are pleased that the SI has collected six articles. The contributions came from academia and industry all around the globe, presenting cutting-edge research in the field and providing deep insights into the developments meant to resolve problems broadly related to tribological applications.

Ma et al. [1] investigated the influence of a double-vane, self-priming, centrifugal pump's bionic circular groove blade surface on wear performance during two-phase flow transfer without compromising its hydraulic performance. This study offers theories and concepts for preventing abrasive wear on machines. In this numerical simulation, the effect of the bionic structural parameters of the double-vane pump on the external properties, pressure field distribution, and anti-wear performance was investigated, as was the ideal groove spacing to enhance the anti-wear properties of the centrifugal pump. The results demonstrated that the pump head's efficiency rises as the bionic blade spacing increases, with smooth blades having the maximum pump head efficiency. Furthermore, the presence of the bionic circular blade enhances the pump's anti-wear performance. This is due to the reverse vortex zone in the groove, which changes the particle trajectory and collision frequency.

Hartung et al. [2] proposed a wear model (finite element code) as a function of the frictional energy rate to predict friction between tire tread blocks and road surface and wear loss in terms of mass. The wear experiments were performed using a high-speed linear tester under contact loads and sliding speeds. An innovative technique for mesh generation and remeshing meshes based on an automatic image analysis of the tread block geometry during linear-friction-tester operations is provided in this research. After that, the rubbing block shape after the wear test was compared to the simulation results. In general, the results show that the geometry of the worn block model following the wear simulation is well-aligned with the output of the image processing tool. Furthermore, the photo quality and image processing settings highly influence the block-shape comparison findings.

Zhao et al. [3] investigated the tribological properties of metal-impregnated graphite, resin-impregnated graphite, and nonmetal-impregnated graphite under high temperatures.

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This study provides the experimental foundation for the application of self-lubricating composites. The tribo-tests were performed using a ball-on-disc tester under a reciprocating sliding motion. The results showed that the metal-impregnated graphite composite displayed the best properties, and the friction coefficient can be reduced by approximately 20% compared with nonimpregnated graphite at 350 °C. However, the metal-impregnated graphite and the resin-impregnated graphite can reduce the wear depth by 60% and 80%, respectively, when compared with a nonimpregnated graphite substrate.

Zheng et al. [4] proposed a two-dimensional lumped-mass model of shrouded blades that included axial and tangential displacements and the derivation of the kinetic equations for the blades under various contact situations. Based on the bilinear hysteresis friction model and the Coulomb friction model, the shrouded blades' nonlinear properties and vibration reduction properties are compared using the fourth-order Runge–Kutta method. The numerical simulations showed that the nonlinear and vibration reduction properties of shrouded blades based on these two friction models are incompatible. The authors reported that the bilinear hysteresis model appears to be more accurate than the Coulomb friction model in the prediction of the response of the shrouded blade system.

Feuchtmüller et al. [5] introduced a novel practical measurement approach to analyze the influence of the shear rate and the film thickness on the viscous friction of reciprocating rod seals. Furthermore, the shear rates were controlled between 105 and 107 s^{-1}. The research thoroughly explains how factors such as the seal ring's geometry, rheological qualities, and surface roughness affect friction. The outcomes of the novel method can be used to validate current simulation models for the reciprocating rod seals' friction and oil film formation.

Sap et al. [6] studied the tribological characteristics of Ti-, B-, and SiCp-reinforced Cu matrix hybrid composites during milling operations compared with those under dry, minimum quantity lubrication (MQL)-assisted, and nitrogen-assisted cooling. The results indicated that cryogenic cooling enhanced the tribological performance by reducing the flank wear tendency, cutting temperatures, and required cutting energy. The tool life can be increased by about 20% and 13% compared to dry conditions by using hybrid composites, cryogenic cooling, and MQL milling.

This SI shows that various approaches have already been successfully applied to solve some tribological challenges. Hence, this SI contributes to the progress in this field. The Guest Editors would like to express their sincere thanks to the authors, reviewers, and editorial staff of MDPI *Lubricants* who provided their professional guidance for the publication of this SI.

Conflicts of Interest: The authors declare no conflict of interest.

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