Special Issue

Symmetry in Intelligent Spindle Modelling and Vibration Analysis

Message from the Guest Editors

Intelligent spindle modeling and vibration analysis are vital for modern manufacturing. Spindles critically influence productivity, precision, and tool life. Accurately modeling stiffness, damping, and cutting forces to prevent chatter remains a key challenge. While AI and data-driven diagnostics grow, physics-based modeling is still essential. Exploiting structural and vibrational symmetry provides deeper dynamic insights for reliable analysis and robust control. Combining physical models with signal processing and machine learning enables real-time monitoring and predictive maintenance. These advances support high-speed machining, requiring greater stability under complex conditions. Research now focuses on hybrid modeling, intelligent fault detection, and adaptive monitoring. Bridging raw vibration data with actionable insights, intelligent spindle modeling is pivotal for resilient, high-performance manufacturing systems.

Guest Editors

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Message from the Editor-in-Chief

Symmetry is ultimately the most important concept in natural sciences. It is not surprising then that very basic and fundamental research achievements are related to symmetry. For instance, the Nobel Prize in Physics 1979 (Glashow, Salam, Weinberg) was received for a unified symmetry description of electromagnetic and weak interactions, while the Nobel Prize in Physics 2008 (Nambu, Kobayashi, Maskawa) was received for the discovery of the mechanism of spontaneous breaking of symmetry, including CP symmetry. Our journal is named *Symmetry* and it manifests its fundamental role in nature.

Editor-in-Chief

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