National Institute of Technology Rourkela

Departmental Seminar

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| Seminar Title | : Nature-Inspired Herringbone Groove Textures: Enhancing the Static and Dynamic Performance of Gas Foil Journal Bearings for Turbomachinery Applications |
| Speaker | : Srusti Priyadarshini |
| Supervisor | : Prof. Saurav Datta (2524), PIC Departmental Seminar |
| Venue | : ME Seminar Hall (ME-001) |
| Date and Time | : 23 Sep 2025 (03:00 PM) |
| Abstract | : Gas foil journal bearings (GFJBs) have received a lot of interest in modern turbomachinery because of their outstanding performance, especially in high-speed and high-temperature environments. The surface texture of bearings plays a crucial role in increasing load-carrying capacity, minimizing friction, and boosting overall efficiency. Nature-inspired designs, such as the convergent, divergent, and constant-width herringbone textures, offer innovative solutions to optimize these characteristics by mimicking effective patterns observed in natural systems. This study investigates the static and dynamic performance of GFJBs with various herringbone groove textures applied to the top foil. Load capacity, frictional torque, and loss of power are examples of static features, whereas dynamic factors like stiffness and damping coefficients are assessed to better understand stability behavior. Numerical simulations based on the Reynolds equation are used to assess pressure distribution and film thickness. This paper presents a novel integrated approach combining numerical analysis and AI-based multi-objective optimization to evaluate and enhance the performance of gas foil journal bearings (GFJBs) featuring nature-inspired convergent herringbone groove textures. While herringbone grooves and biomimetic textures have been individually explored, this work uniquely investigates their effect and employs machine learning tools to optimize critical geometric parameters for improved static and dynamic performance.The findings highlight the relevance of surface texturing in enhancing GFJB technology and provide a thorough understanding of the relationship between groove design and bearing performance. This research offers valuable insights for designing and applying high-performance GFJBs in air cycle machines and other turbomachinery applications, paving the way for improved efficiency, reliability, and sustainability. Keywords: GFBs, Herringbone Groove, Static, Dynamic, Bio-inspired |