INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Prediction of Textured Journal Bearing Performance Characteristics implementing Mass Conserving Boundary Conditions using Progressive Mesh Densification Method

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SHORT ABSTRACT

Surface texturing is proven to be a feasible technique for enhancement of the performance characteristics of the hydrodynamic bearings. A considerable amount of numerical and experimental study is carried out on textured hydrodynamic bearings. The surface texturing onto the bearing surface can be done using different micro-fabrication techniques such as laser surface texturing (LST), chemical etching techniques, novel dressing techniques, Additive manufacturing, abrasive jet machining, photolithography, focused ion beam, micro-electric discharge machining, electrochemical texturing, ultrasonic machining, thermal implantation etc. The surface texture of regular geometries, either dimpled or protruded shapes, can be produced on the bearing surface with the above-mentioned manufacturing techniques.

The present dissertation deals with implementing a simple computational algorithm, i.e., the progressive mesh densification (PMD) method, to textured journal bearing problems. Its computational performance is compared with the multigrid (MG) and fixed mesh density (FMD) methods while implemented to spherical dimple textured journal bearing. It is found that the PMD method is superior in computational performance compared to MG and FMD methods for fixed texture parameters for length-to-diameter (L/D) ratios of 0.2, 1 and 2 whereas, in the case of varying texture parameters for the L/D ratio of unity.

Further, the spherical protruded and dimple textured journal bearings' performance characteristics are compared with the untextured bearing ones for the L/D ratio of unity. The discretized governing Reynolds equation

considering the mass conserving (JFO) boundary conditions has been solved using the computationally efficient PMD method. The numerical code developed is validated with the experimental results available in the literature. It has been noticed from the numerical analysis that the dimple textured journal bearing provides better performance compared to the protruded textured and untextured journal bearing for load carrying capacity and flow coefficient whereas, protruded textured journal bearing gives better performance compared to the dimple textured and untextured journal bearing for friction variable. For better performance, dimple and protruded textured bearings must be textured in the second-half textured region configuration.