A CFD study comparing surface texture features on stationary and entraining surfaces

Proceedings of the 42th Leeds-Lyon Symposium on Tribology
September 7-9, 2015, Lyon, France

A CFD STUDY COMPARING SURFACE TEXTURE FEATURES ON STATIONARY AND ENTRAINING SURFACES

N. Morris*, H. Shahmohamadi, R. Rahmani, H. Rahnejat
*N.J.Morris@lboro.ac.uk
[a] Wolfson school of Mechanical and Manufacturing Engineering, Loughborough University, LE11 3TU, UK

ABSTRACT

Surface texturing has been used to enhance the tribological properties of a variety of machine elements. Piston rings, face seals and journal bearings have all shown improved tribological performance due to introduction of surface textured features. A multitude of texture geometries, shape, locations and manufacturing techniques have been investigated in an attempt to optimize the texture features imparted on to the surface.

A parameter which is commonly neglected during the investigation and application of textured features is on which surface (stationary or entraining) the textured feature should reside. The choice of which surface to texture is often influenced by the constraints of the available manufacturing process, material and expected wear of the contiguous surfaces. In some application the decision is less constrained and the speed of surface that the texture is applied to should be considered.

A computational fluid dynamic analysis is conducted to investigate the influence of textures on the stationary and moving surface. The Navier-Stokes and continuity equations for multi-phase flow conditions are solved using a finite volume method. A vapour transport equation is also included to ensure continuity of flow in the cavitation region for the multiple phases as well as Rayleigh-Plesset to take into account the growth and collapse of cavitation bubbles.

The results indicate that the position of surface texture features on either the stationary or entraining surface is a parameter worthy of consideration. It is recognized by the authors however that that this is not always possible due to manufacturing constraints, material choices and wear rates of surfaces.

ACKNOWLEDGMENTS

The authors would like to express their gratitude to the Lloyd's Registry Foundation (LRF) for the financial support extended to this research.