38th Annual Meeting
Turbomachinery Research Consortium
May 15 – 17, 2018

Half page Synopsis of Reports for website | Due: Sunday, May 6, 2018

Drag Reduced, Textured Surface Bearing and CFD of Tilt Pad Journal Bearings

By Dr. Alan Palazzolo a-palazzolo@tamu.edu and Jonin Yang jiyang@tamu.edu

Summary:

Proposed Modeling in this research is the first simulation model of Titling Pad Journal Bearing based on three dimensional CFD approach, including multiphase flow, thermal-fluid, transitional turbulence, thermal rotational shaft & pad motion and thermal deformation of shaft and pads by two-way Fluid Structure Interaction (FSI) Analysis approach and provide rotordynamic dynamic coefficient by CFD. Developed CFD model was compared with conventional generalized Reynolds model with 3D energy equation and the results have shown that Mixing theory of Reynolds can have non-negligible uncertainty and low accuracy on some result parameters due to simplification of between pad region modeling. It stressed necessity of development of CFD modeling and the CFD modeling will be used to supplement the Reynolds model as a future work.

Meanwhile, the ideal bearing has high lift and low drag similar to an airplane wing. Bearing losses increase with machine size and speed reaching as high as 1 - 2 MW loss per bearing in large TGS. This amount of loss is roughly the equivalent of the power used in about 1,000 homes. In this study, Drag reduced journal bearing for fixed and non-fixed pad journal bearings are newly proposed. CFD simulation results that support the proposed techniques have shown 10 ~ 25 % drag torque and power loss reduction, 0 ~70 % supply flow rate reduction, 0 ~ 13% shortened bearing length while maintaining minimum film thickness and maximum pad temperature. Rotordynamic coefficient with minor decrease for developed drag reduced techniques also have been provided.