Feasibility Study of Spiral Grooved Thrust Bearing for Turbocharger Rotor

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Abstract: The thrust bearing in turbomachinery supports the axial loads of the rotor. These axial loads are because of the pressure difference between the turbine and compressor wheels. In turbochargers, presently simple taper land thrust bearings are widely used and they are found to have poor performance and short life. To enhance its performance, thrust bearings with grooves can be replaced. The grooved thrust bearings are found to be quite stable and efficient in operation for various other applications. Therefore, the author believes a feasibility study of spiral grooved bearings for locomotive turbochargers will be quite helpful to the engineers. The target for the current study is to design an aerodynamic spiral grooved thrust bearing (SGTB) based on static analysis and optimization. The static analysis includes prediction of the pressure profile, load-carrying capacity (LCC), and film thickness. Further, the optimum groove parameters for SGTB have been obtained for the calculated thrust load of the turbocharger rotor. In this analysis, compressible Reynold's equation is solved using FDM to determine pressure profile over the surface of spiral grooved bearing. From the estimated pressure profile, LCC is calculated which is compared with the previously calculated thrust load of the locomotive turbocharger. For the feasibility study, various bearing parameters such as number of grooves, spiral angle, and film thickness ratio are optimized.

Keywords: Spiral grooved bearings, Turbocharger, Thrust bearing, Reynold's equation.

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