National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Influence of straight radial groove texture on the performance of gas foil thrust bearings with and without slip flow
Speaker	: Pranabini Panda (523me7009)
Supervisor	: Prof. Saurav Datta (2524), PIC Departmental Seminar
Venue	: ME Seminar Hall (ME-001)
Date and Time	: 23 Sep 2025 (03:30 PM)
Abstract	: Gas foil thrust bearings (GFTBs) have a wide range of applications in oil-free turbo machinery due to their advantages, such as low maintenance, high speed ability, environmental friendliness, and a wide range of temperature adaptability. However, the use of GFTBs is limited due to the low load-carrying capacity (LCC). This study develops a novel GFTB, engraving the straight radial grooves on the top foil surface to enhance the LCC. For numerical simulations, the 2D compressible, isothermal, and isoviscous Reynolds equation is solved by the finite difference method (FDM) to obtain gas film thickness and pressure distribution. A marked increase in LCC and a nominal decrement of frictional torque are seen with a speed of 50 krpm compared to its conventional non-grooved GFTBs. Additionally, as GFTBs operate at very low clearance and at high speeds, slip flow is considered at the solid gas interface. For accurate prediction of LCC and frictional torque Reynolds equation is modified by inserting the Knudsen number. The LCC and frictional torque with slip flow are assessed, and the result is compared to no-slip conditions. The result declares that the conventional Reynolds equation overestimates the LCC and frictional torque by 6% at 50 krpm. Keywords: Reynolds equation, Turbomachinery, Slip flow, FDM