

EML 6506 Fluid Film Lubrication
University of Florida
Mechanical Engineering Department

- Professor Nagaraj Arakere
- Textbook: *Fundamentals of Fluid Film Lubrication*
by Bernard J. Hamrock , McGrawhill
- Prerequisites: EML 4702, ENG 3353, or EAS 4106
- Goals: Theory, analysis, and design of hydrodynamic and hydrostatic bearings. A comprehensive approach to the analysis and design of journal and thrust bearings for applications in various types of high and low-speed rotating machinery. Design of gas-lubricated bearings is also covered for cryogenic and high temperature applications. Analysis techniques using both analytical and numerical methods (finite difference and finite element) are introduced, to solve the governing equations for fluid-film lubrication.
- Topics: 1. Introduction- Bearing classification and selection, conformal and nonconformal surfaces, surface topography, computation of surface parameters.
2. Lubricant properties- Newtonian fluids, viscosity-pressure, viscosity-temperature, and viscosity-shear rate effects, etc.
3. Bearing materials
4. Viscous Flow-Governing equations, Order of magnitude analysis of Navier-Stokes equations (multiple length scales), Reynolds equation
5. Hydrodynamic Thrust Bearings-Analytical Solutions
6. Hydrodynamic Thrust Bearings-Numerical Solutions
7. Hydrodynamic Journal Bearings-Analytical Solutions
8. Hydrodynamic Journal Bearings-Numerical Solutions
9. Dynamically Loaded Journal Bearings- Interaction between rotor dynamics and bearing forces.
10. Hydrodynamic Squeeze-Film Bearings
11. Hydrostatic Lubrication
12. Gas-Lubricated Thrust Bearings
13. Gas-Lubricated Journal Bearings
- Homework: Several projects involving detailed design of journal and thrust bearings for applications in rotating machinery will be assigned.
- Computer Support Required: Mathematical PC software packages such as MATLAB, MAPLE or MATHCAD will be essential, for implementing analytical and numerical solutions.