

INTRODUCTION TO LUBRICATED HYDRODYNAMIC BEARINGS - STATIC AND DYNAMIC BEHAVIOR

Part 1 (2h): Static Behavior

1. Introduction:
Limit, mixed and lubricated friction regimes.
Hydrodynamic lubrication: the oil wedge effect.
Bearing technology: terminology, bearing types.
2. Hydrodynamic thrust bearings:
Load carrying capacity, friction and leakage in a tapered land bearing.
Main Types of Hydrodynamic thrust bearings with Fixed Pads.
Tilting pad thrust bearings.
3. Hydrodynamic journal bearings:
Load carrying capacity, friction and flow in the circular journal bearing.
Main types of hydrodynamic bearings.
Turbulence.
4. Thermal effects in hydrodynamic bearings.
5. Specific effects during starting and stopping of hydrodynamic bearings.

Part 2 (2h): Dynamic Behavior

6. Introduction:
Main sources of vibration in rotating machines.
Forced vibrations of 1DDL systems: resonance, transmitted effort.
The stiffness and damping of a lubricant film: the squeeze effect.
7. Dynamic behavior of the hydrodynamic thrust bearing:
Direct stiffness and viscous damping.
8. Dynamic behavior of hydrodynamic journal bearings:
Direct and cross stiffness, damping.
Instabilities generated by the circular bearing: self-sustained vibrations.
Dynamic behavior of lobe and tilting-pad journal bearings.
9. Linear dynamic response of rotors guided by lubricated bearings.

Bibliography:

- [1] FRENE, J., NICOLAS, D., DEGUERCE, B., BERTHE, D., GODET, M. – Lubrification hydrodynamique. Paliers et Butées, Edition Eyrolles, 1990.
- [2] FRENE J. – *Butées et paliers hydrodynamiques*, Technique de l'Ingénieur, B 5 320 1-38.
- [3] LALANNE (M.) et FERRARIS (G.) – *Dynamique des rotors en flexion*, Technique de l'Ingénieur, B 5 110 1-39.

This tutorial is aimed at industrial workers who work with rotating machines operating with lubricated hydrodynamic journal and thrust bearings. Training can be either a first contact with problems of lubrication or an updating of previous knowledge.