MIET2510

Mechanical Design

Week 4 – Bearing and Lubrication – Part 2

School of Science and Technology, RMIT Vietnam

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Journal Bearing (Plain Bearing)

The journal bearing or **sleeve bearing** supports a load in the radial direction. It has two main parts: a shaft called the journal and a hollow cylinder or sleeve that carries the shaft, called the bearing.

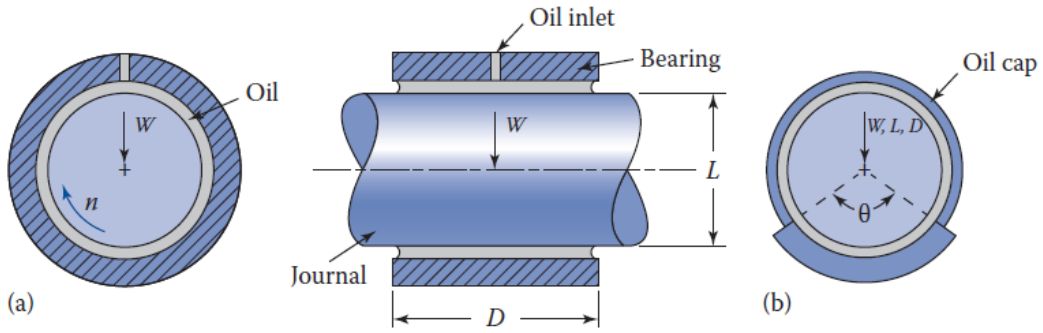

FIGURE 10.1
(a) Full-journal bearing and (b) partial-journal bearing. *Notes*: *W*, load; *L*, bearing length; *D*, journal diameter; *n*, journal rotational speed; θ, angle of partial bearing.

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Journal Bearing Design

- The design of journal bearings usually involves two suitable combinations of variables:
  - **1) variables under control** (viscosity, load, radius and length of bearing, and clearance)
  - **2) dependent variables (performance factors** including coefficients of friction, temperature rise, oil flow, and minimum oil-film thickness).
- Essentially, in bearing design, limits for the latter group of variables are defined. Then, the former group is decided on so that these limitations are not exceeded.

Journal Bearing Design

1. Lubricants: Lubricants are characterized by their viscosity. Their choice is based on such factors as type of machine, method of lubrication, and load features.

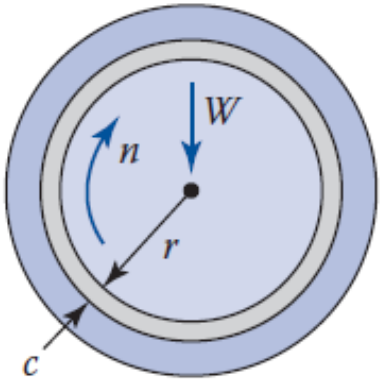
2. Bearing Load: The value of the load per projected area, P, depends on the length and diameter of the bearing. Obviously, the smaller P, the greater the bearing life.

Journal Bearing Design

3. Length-Diameter Ratio: Various factors are considered in choosing proper length-to-diameter ratios, or L/D values. Bearings with a length-to-diameter ratio less than 1 (short bearings) accommodate the shaft deflections and misalignments that are expected to be severe. Long bearings (L/D > 1) must be used in applications where shaft alignment is important.

Journal Bearing Design

4. Clearance: The effects of varying dimensions and clearance ratios are very significant in a bearing design. The clearance ratios (c/r) typically vary from 0.001 mm to 0.002 mm and occasionally as high as 0.003 mm.



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Lubrication

- **Hydrodynamic Lubrication:** Load-carrying surfaces of the bearing are separated by a (relatively thick) layer of fluid, called fluid film.
- **Mixed Lubrication:** Mixed lubrication describes a combination of partial lubricant film plus intermittent contact between the surfaces.
- **Boundary Lubrication:** Boundary lubrication refers to the situations in which the fluid film gets thinner and partial metal-to-metal contact can occur.

Lubrication

- **Elastohydrodynamic Lubrication**: Elastohydrodynamic lubrication is concerned with the interrelation between the hydrodynamic action of full-fluid films and the elastic deformation of the supporting materials. It occurs when the lubricant is introduced between surfaces in rolling contact, such as mating gears and rolling bearings.
- **Hydrostatic Lubrication**: Hydrostatic lubrication refers to the continuous supply of flow of lubricant to the sliding interface at some elevated hydrostatic pressure. It does not require motion of the surfaces relative to another.

Thank you for your attendance :D

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Reference

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- *Mechanical Design of Machine Components (2nd) by Ansel C.Ugural.*
- *Mechanical Engineering Design (10th) by Richard G.Budynas and J. Keith Nisbett.*
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