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Introduction

Background:

• Rolling element bearing: *Service life*??

• Greased and sealed for life:
  *Service life* is determined by *grease life*.

• *Grease life*: Maintain a sufficiently thick lubricant film.
Introduction

Aim of this research:
• Develop a model that predicts change supply layer thickness.
• Use this model to predict long term film thickness decay.

Supply layer thickness $\hat{U}$  Film thickness
Introduction

Contact pressure effect

Centrifugal effect

Lubricant film thickness distribution
Theory

Model: contact pressure effect

- Rolling tracks are covered by a thin layer of lubricant.
- Lubricant is distributed evenly along the tracks.
- Considering flow due to “high” contact pressures:
  - Elastic deformation
  - Viscosity – Pressure dependence
  - Density – Pressure dependence
- For a symmetrical distribution:

\[
h(t) = \frac{1}{\sqrt{C t + h_0^{-2}}}
\]

\[
C = C(\eta_0, l_t, F, E', \alpha, \text{geometry})
\]
Experimental approach

- Roller loaded against rotating glass disk.
- Small droplet of oil.
- Film thickness is measured using optical interferometry.
Experimental results

Central film thickness - Different Loads

$u_m = 186$ mm/s, $\eta_0 \approx 0.8$ Pa.s
Conclusion

• Grease life prediction: Film thickness is determined by supply layer.

• Model is developed to predict change of supply layer.
  – Centrifugal effects
  – Contact pressure effects

• Model is validated experimentally.