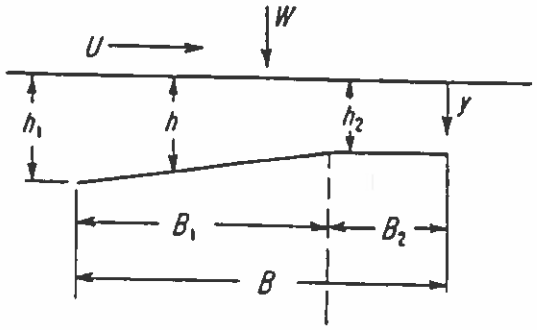
Tribology Ph.D. Qualifying Exam
Fall 2014

Instructions:

1. You must solve the two problems. They are of equal weight.
2. Write your work clearly in dark ink. Define all your variables. If you need to make assumptions, justify those briefly. Do not assume that the examination committee can "guess" what you "mean."
3. Budget your time. Concentrate on concepts and setting up the solution first. Then work out the math as necessary.

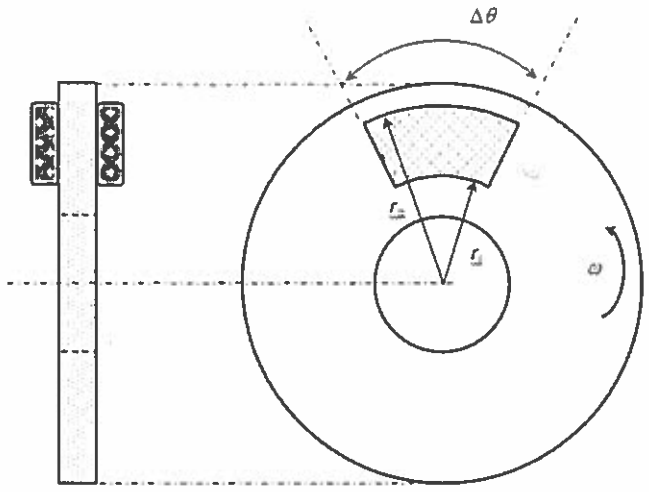
Problem 1

The bearing termed "composite" is shown in the figure below. It is made up of a combination of tapered-land and a flat-land. The bearing is "long" such that side flow is negligible. Determine the pressure distribution, and plot it schematically along the bearing.



Problem 2

Consider the disc brake shown below.



a) Assuming a kinetic coefficient of friction of μ and a **uniform** pad pressure, derive an expression for the braking torque in terms of the compressive force, N, that each pad exerts on the rotor.
b) Appealing to Archard's Wear Law, make an argument as to why uniform pressure leads to a non-uniform rate of change of pad thickness. That is, the rate of change of pad thickness would vary radially. (Assume that the rotor remains perfectly planar.)
c) Find the radial pressure distribution consistent with Archard's Wear Law. Express in terms of the compressive force, N.