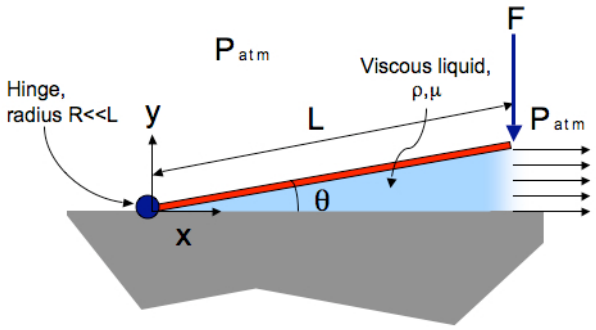
MIT Department of Mechanical Engineering
2.25 Advanced Fluid Mechanics

Problem 6.20
This problem is from "Advanced Fluid Mechanics Problems" by A.H. Shapiro and A.A. Sonin



A flat plate of breath L and length much greater than its breadth is attached to a plane floor by a hinge. The hinge has a radius R as shown. The plate is initially at a small angle θ_0 relative to the floor, and the region between it and the floor is filled with a viscous liquid. Starting at $t = 0$, the plate is forced toward the floor at a constant angular rate $-\frac{d\theta}{dt} = \omega$.

- Obtain an expression for the pressure distribution $p(x, t)$ under the plate in the limit of highly viscous (inertia-free) flow. The given quantities are L, R, θ, ω, ρ, μ, and the atmospheric pressure p_a outside the plate.
- Derive an expression for the vertically force $F_y^{tip}(t)$ which must be applied at the right-hand tip of the plate to make it close down at the specific constant angular rate.
- Write down the criteria which must be satisfied for your solutions to apply

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