

Figure 1.

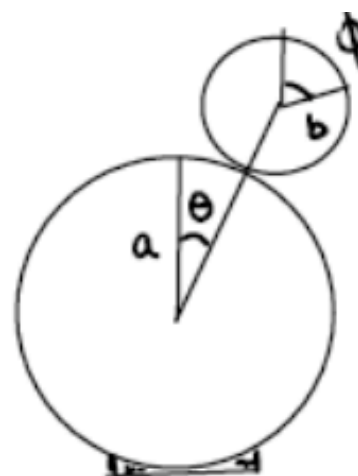


Figure 2.

With reference to Figure 2, a small cylinder sits initially on top of a larger cylinder of radius a , the latter being attached rigidly to a table. The smaller cylinder has mass m and radius b . A small perturbation sets the small cylinder in motion, causing it to roll down the side of the large cylinder. Assume that the coefficient of static friction μ is sufficiently large that there is initially no slippage between the two cylinders. Using the method of Lagrange multipliers find the Lagrange's equations and expressions for the generalized forces of constraint. Analyze their relation with the normal force and the force of static friction. Noticing that as the cylinder rolls down the static friction will eventually not be enough to maintain it rolling without slipping, determine the angle θ for which the cylinder starts slipping.