

Problem

Two uniform bars are hinged together at one end with a massless hinge and are free to slide in contact with a smooth, semicircular bowl of radius R (as shown below). One rod has mass M_1 and length $2l_1$ and the second rod has mass M_2 and length $2l_2$. The bowl is attached to a table and does not move. The system is acted on by gravity. Each rod has two points of contact with the bowl, at the hinge point and at the lip of the bowl (neither rod falls inside the bowl). For the following consider motion only in the plane of the two rods (2 dimensional problem).

- How many independent degrees of freedom are there in this system?
- Determine the potential energy of the two bar system.
- Determine the Lagrangian for the two bar system.
- Determine the angle θ made by the first bar with respect to the horizontal after the two bar system reaches equilibrium (motion is damped out).

