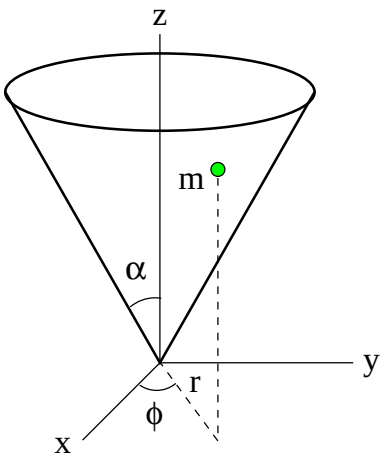
[mex157] Routhian function for heavy particle sliding inside cone

Consider a conical surface with vertical axis (z) and apex with angle 2α at the bottom in a uniform gravitational field g. A particle of mass m is free to slide on the inside of the cone.
(a) Express the Lagrangian in the generalized coordinates r, ϕ.
(b) Identify the cyclic coordinate and identify the Routhian function which eliminates the cyclic coordinate.
(c) Derive the equation of motion for the noncyclic coordinate and an integral expression for the cyclic coordinate.



Solution: