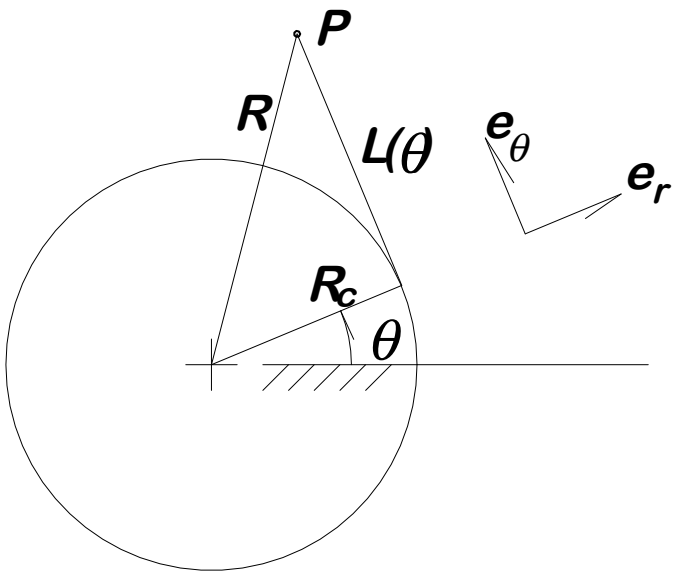

Particle on a Cord Winding Onto a Cylinder

Position of Particle P is $\mathbf{R}$

$\mathbf{R} = R_c \mathbf{e}_r + L(\theta)\, \mathbf{e}_\theta$

$d\mathbf{R} = \frac{d\mathbf{R}}{d\theta} d\theta$

$= R_c\, d\theta\, \mathbf{e}_\theta + \frac{dL}{d\theta}\, d\theta\, \mathbf{e}_\theta + L(\theta)\ d\theta\ (-\mathbf{e}_r)$

$= R_c\, d\theta\, \mathbf{e}_\theta - R_c\, d\theta\, \mathbf{e}_\theta - L(\theta)\ d\theta\, \mathbf{e}_r$

$= -L(\theta)\ d\theta\, \mathbf{e}_r$

The force in the cord is $\mathbf{T}$

$\mathbf{T} = -T\, \mathbf{e}_\theta$

The increment of work is then

$dW = \mathbf{T} \cdot d\mathbf{R} = (-T\, \mathbf{e}_\theta) \cdot (-L(\theta)\ d\theta\, \mathbf{e}_r) = 0$

This means that the system is conservative, and conservation of energy applies to this system.