LCP4

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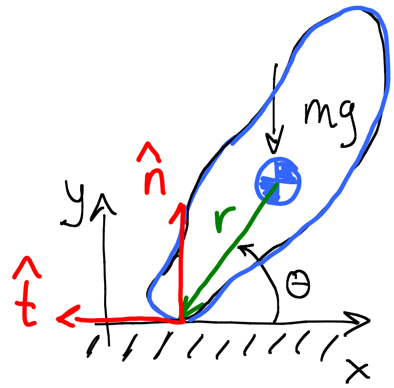
This is a planar problem

At the current time a rigid body is in contact with a horizontal support surface ($y=0$) while translating to the left.



$d = \|r\|$

μ = friction coeff

(x,y) = center of grav. location

m = mass of body

J = moment of inertia

Write the instantaneous equations of motion in terms of λ_n and $\ddot{\Psi}_n$. The result should be an LCP of size 1 in λ_n:

$$0 \le \lambda_n \perp \underbrace{A\lambda_n + b}_{\ddot{\Psi}_n} \ge 0$$

Getting started: $u = \begin{bmatrix} x \\ y \\ \theta \end{bmatrix}$ $\quad \nu = \begin{bmatrix} \nu_x \\ \nu_y \\ \omega_z \end{bmatrix}$

Write $\Psi_n(\theta)$.

Write Newton Euler equations.

$$\begin{bmatrix} m & & \\ & m & \\ & & J \end{bmatrix} \dot{\nu} = G_n \lambda_n + G_t \lambda_t + \text{stuff independent of } \lambda_n, \lambda_t$$

Translating left and in contact $\Rightarrow$ $\omega_z = \nu_y = 0$
$\nu_x < 0$.

Use these initial conditions to eliminate λ_t!

Similarly eliminate $\dot{\nu}_x, \dot{\nu}_y, \dot{\omega}_z$, so the only unknown is λ_n.

1. Derive the scalars A and b in terms of g, m, J, d, μ, and θ.

2. Let $m = d = \mu = 1$ and $J = 0.1$.

   a. Find values of g & θ such that λ_n is unique

   b. Find values of g & θ such that no solution exists.