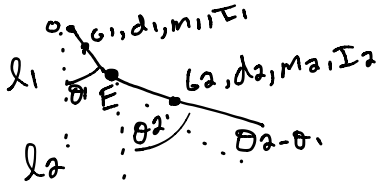
Lagrange Equations in Matlab

DAE's for linkages



Lagrange Equations (conservative holonomic) (no explicit dependence on time)

$\mathcal{L} = T - V = E_K - E_P$ $\quad E_P = E_P(q_1, q_2, \ldots)$ → only q's

$E_K = E_K(q_1, q_2, \dot{q}_1, \dot{q}_2 \ldots)$ → q's and $\dot{q}$'s

LE: $\frac{\partial \mathcal{L}}{\partial q_1} - \frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{q}_1} = 0$

$\frac{\partial \mathcal{L}}{\partial q_2} - \frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{q}_2} = 0$

$\frac{\partial \mathcal{L}}{\partial \dot{q}_1}$: treat $\dot{q}_1$ as a variable

$\frac{\partial \mathcal{L}}{\partial \dot{q}} = F(q_1, q_2, q_3 \ldots)$

$\frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{q}} = \frac{d}{dt}F = \frac{\partial F}{\partial q}\dot{q}_1 + \frac{\partial F}{\partial q_2}\dot{q}_2 + \frac{\partial F}{\partial \dot{q}_1}\ddot{q}_1 + \frac{\partial F}{\partial \dot{q}_2}\ddot{q}_2 \ldots$

jacobian(a, b) b is a list of variables, a is a list of expressions

either can be rows or columns

output of jacobian = matrix, each element = $\frac{\partial a_i}{\partial b_j}$