

Euler Lagrange Formulation for Dynamics

- Principle of least action $L = KE(q, \dot{q}) - PE(q)$

$$\min_{q(t)} \int L(q(t), \dot{q}(t), t) dt$$

- Unconstrained solution

$$\frac{d}{dt} \left(\frac{\partial L}{\partial \dot{q}} \right) - \frac{\partial L}{\partial q} = Q + F_{\text{non-conservative}}$$

Velocity Constraints