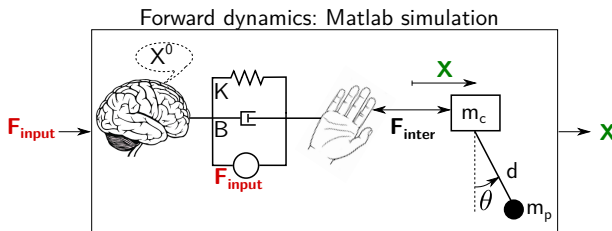


# Simulation of coupled model = Cart-Pendulum + Arm impedance



$$(m_c + m_p) \ddot{X} = m_p d [\dot{\theta}^2 \sin(\theta) - \ddot{\theta} \cos(\theta)] + F_{inter}$$

$$\ddot{\theta} = -\frac{\ddot{X}}{d} \cos(\theta) - \frac{g}{d} \sin(\theta)$$

$$F_{inter} = F_{input} - K(X - \mathbf{X}^0) - B(\dot{X} - \dot{\mathbf{X}}^0)$$

## Assumptions

- ▶  $X^0, \dot{X}^0$ : desired cart trajectory  $\rightarrow X^0(t) = A \sin(\omega t + \frac{\pi}{2})$
- ▶  $F_{input}$ : assume rigid object  $\rightarrow F_{input}(t) = (m_c + m_p) \ddot{X}^0$
- ▶  $F_{input}, X^0, K, B$  are **not modified** during a simulated trial