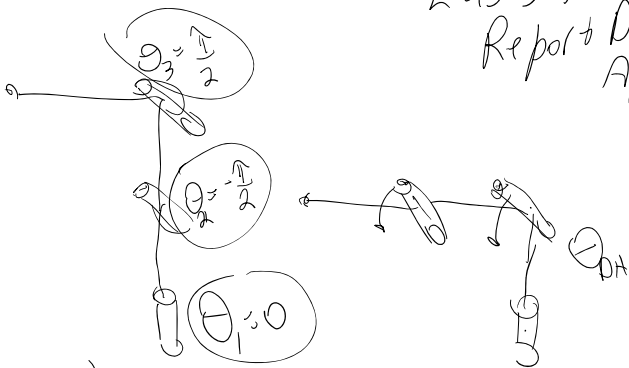


Lab 3 ME446  
Report Due  
April 17



Robot

$$\tau = D(\theta)\ddot{\theta} + C(\theta, \dot{\theta})\dot{\theta} + g(\theta)$$

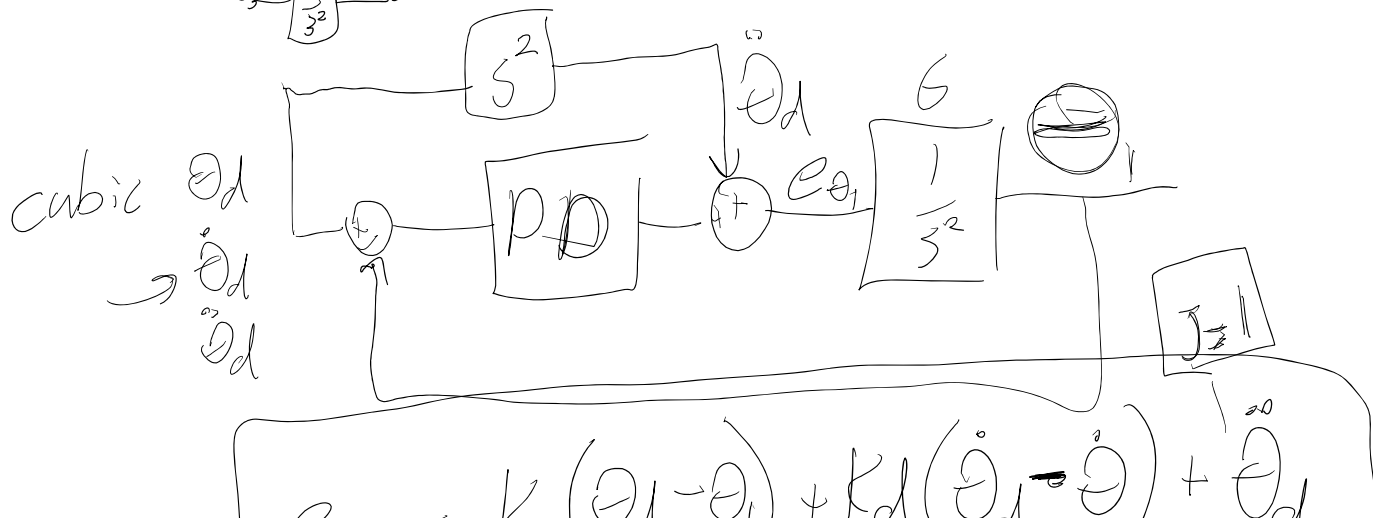
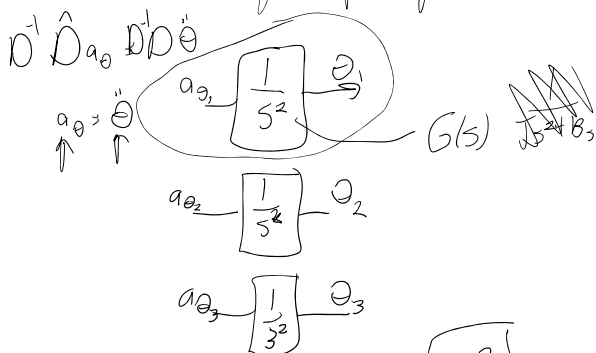
measure  $\theta_1, \theta_2, \theta_3 \quad \dot{\theta}_1, \dot{\theta}_2, \dot{\theta}_3$  "real"

$\theta$  feedback estimate  $\dot{\theta}$   
~~estimate  $\ddot{\theta}$~~

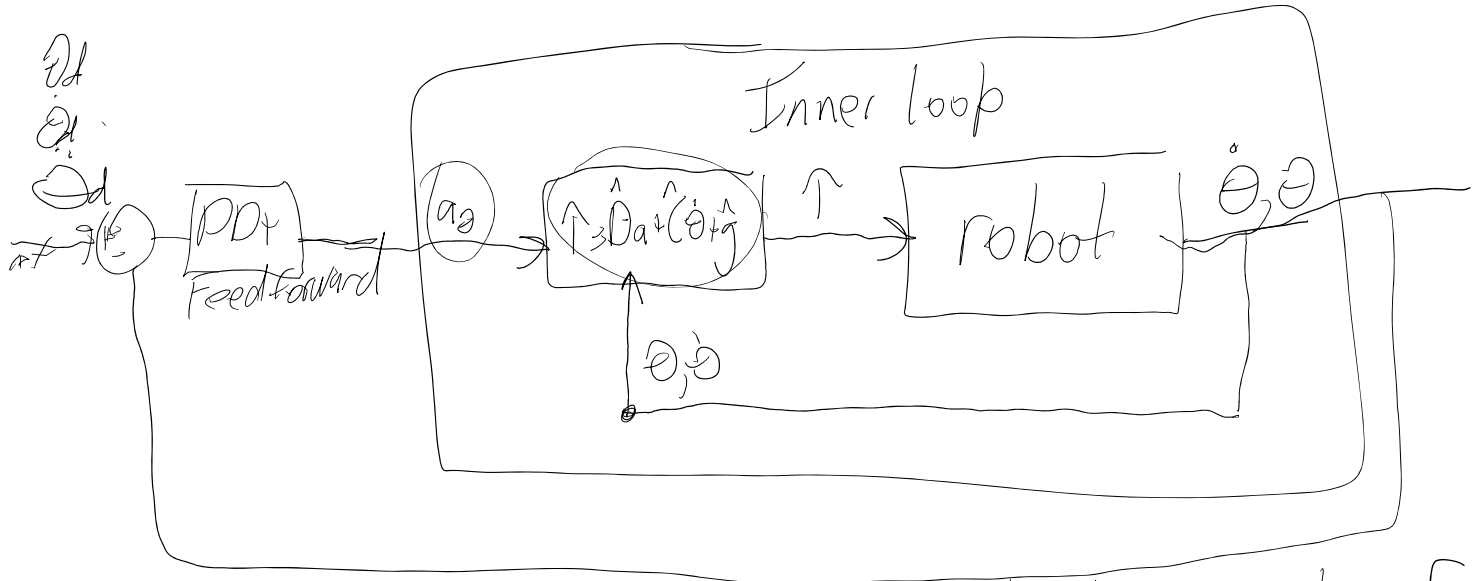
$$\tau = u = \hat{D}(\theta) \ddot{\theta} + \hat{C}(\theta, \dot{\theta}) \dot{\theta} + \hat{g}(\theta)$$

Real System

$$\hat{D}a_{\theta} + \hat{C}\dot{\theta} + \hat{g} \Rightarrow \tau = D\ddot{\theta} + C\dot{\theta} + g$$



$$\tau = K_p(\theta_d - \theta) + K_d(\dot{\theta}_d - \dot{\theta}) + \dot{\theta}_d$$



Outer loop calculate outer first  
then given  $a_2$  calculate torque