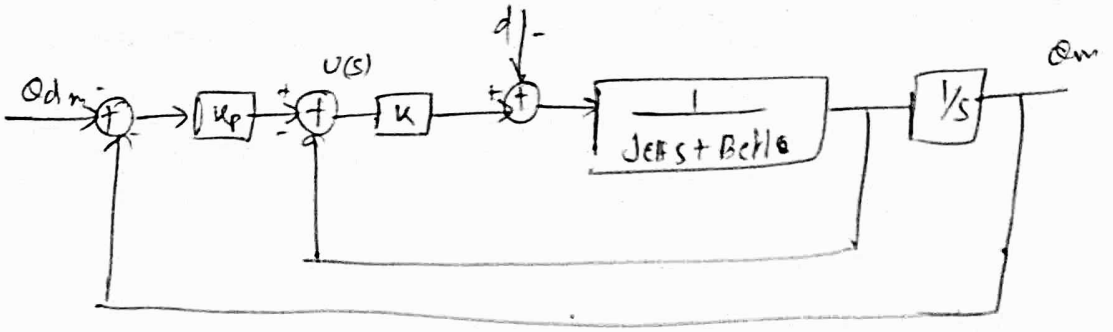
PUPUL DALBEHERA
SECRET CODE:DEV

Q3

(a) PD control.



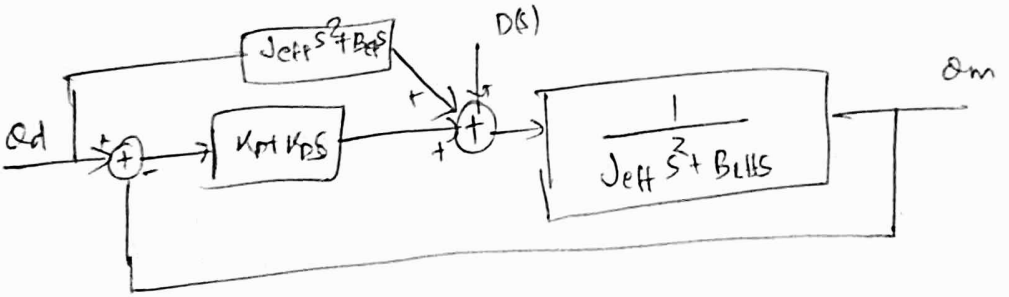
Control equation is

$$U(s) = K_P(\theta_d - \theta_m) + K_d(\dot{\theta}_d - \dot{\theta}_m)$$

$K_{P_1} = 10, 3, 1$

$K_{D_1} = 5, 1.25, 1$

(b) Same PD with feed forward model



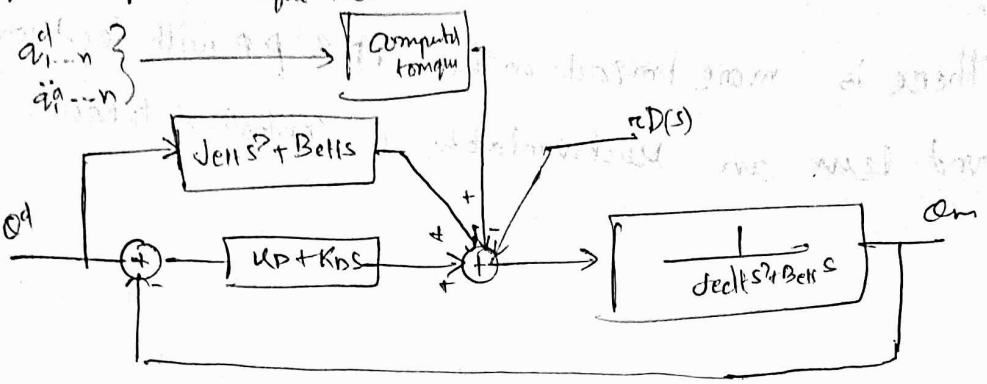
Control equation is

$$U(S) = K_P(\theta_d - \theta_m) + K_D(\dot{\theta}_d - \dot{\theta}_m) + J_{eff}\ddot{\theta}_d + B_{eff}\dot{\theta}_d$$

$K_P = 10, 3, 1$ $\quad J_{eff} = 10$

$K_D = 5, 1.25, 1$ $\quad B_{eff} = 10$

(c) Same PD control along with a feed forward disturbance cancellation using computed torque method.



$$u(t) = K_d(\theta_d - \theta_m) + K_D(\dot{\theta}_d - \dot{\theta}_m) + J_{eff}\ddot{\theta}_d + B_{eff}\dot{\theta}_d + M(q)\ddot{q}_d + C(q,\dot{q})\dot{q}_d + G(q)$$

Same as before $M(q)$, $C(q,\dot{q})$, $G(q)$ is calculated.

(d) Multivariable control

$$u = M(q)a_q + C(q,\dot{q})\dot{q}_d + G(q)$$

$$a_q = \ddot{q}_d + K_e(e) + K_e(\dot{e})$$

$$e = q_d - q_m$$

Observation:=>

Q 4, 5, 6,

There is more Impact on the PD, & P D with feed forward and less on Manipulated & Controlled Param.