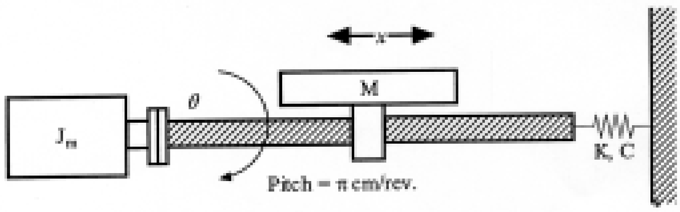
元智大學

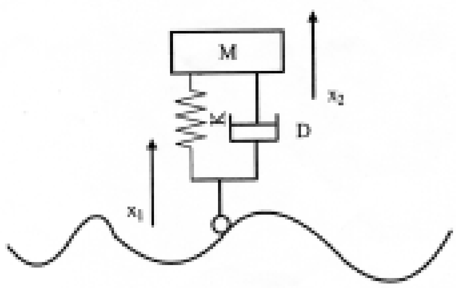
博士班資格考試 － 自動控制

10/7/2002

1. Take a frequency response (Bode diagram) approach to explain the effects of P, PD and PID controllers in a closed-loop control system (15%)
2. Explain the "windup" phenomenon in a PID controlled system and what is the usual measure to remedy it. (10%)
3. Design a digital control system for the open-loop system $G(s)=\frac{8000}{s^2+100s+10000}$ to increase the damping of the system to ζ=0.8, .i.e. an active damping control design, and keep the steady state gain of the resultant closed-loop system to 1. The answer should include explanation for the selection of the sampling rate and the design approach. (20%)
4. A motion control system has the following parameters: K=32 N/rad, C=0.32 $N\ sec/rad$, M=400 Kg, J_m=0.04 $Kg\ m^2$, pitch = π cm/revolution, Please derive the transfer function between the input angular position $\theta(t)$ and the linear output displacement $x(t)$. (20%)



5. Find the transfer function of the suspension system (M=100 Kg, K=10000 N/m, C=1600 N sec/m) between the input road surface displacement $x_1(t)$ and the suspended mass displacement $x_2(t)$ and draw the corresponding frequency response (Bode diagram) and find the step response of the system to a unity step input $x_1(t)$. (25%)



6. Compare between the output feedback and the state feedback control structure, and indicate their difference in performance. (10%)