SSY156 - Modelling and Control of Mechatronic Systems
Peer-2-Peer Homework 04

Question 1

For a single joint motor system (torque-controlled) with the specifications: $I_m = 1.8\ \text{kg} \cdot \text{m}^2$, $k_t = 0.5\ \text{N} \cdot \text{m/A}$, $F_m = 0.25\ \text{N} \cdot \text{m} \cdot \text{rad/s}$, design a decentralized independent joint control with position and velocity feedback, that yields in a close-loop response with a Disturbance Rejection Factor (DRF) of 0.0013 and an Output Recovery Time (ORT) of 7.2 s when subjected to load disturbance.

Question 2

Plot two 3D surfaces of the DRF and ORT as a function of the controller parameters K_V (between 0 and 0.3) and K_P (between 0 and 10). *(Hint: you can use meshgrid and surf to do the plots)*

What is the minimum value of ORT. What is the physical meaning of this phenomena?

Question 3

How the closed-loop response will react to load-disturbances if a very large K_P is used?

Question 4

Plot two 3D surfaces of the close-loop natural frequency and damping factor as a function of the controller parameters K_V (between 0 and 0.3) and K_P (between 0 and 10).

What is the effect of increasing the controller parameter K_P in the close-loop response natural frequency and damping factor? What implications it has on the time constant and the overshoot of the closed-loop response?