

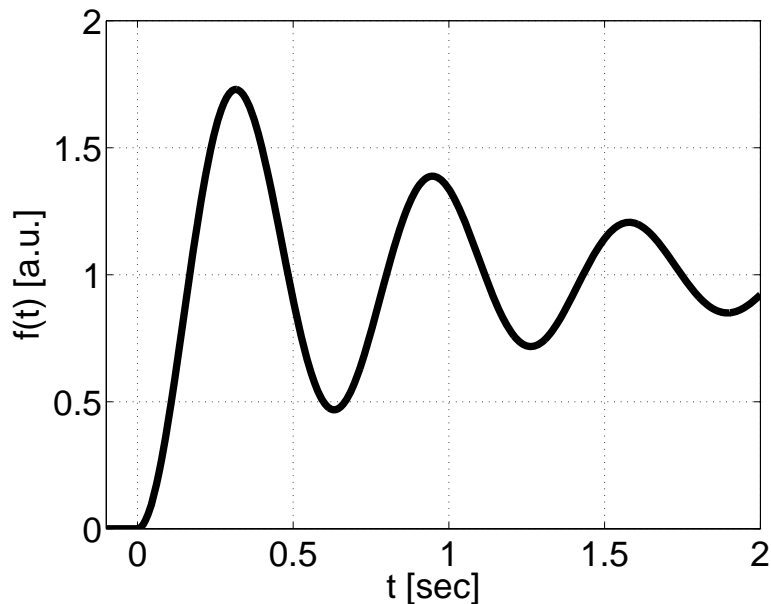
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mechanical Engineering
2.004 Dynamics and Control II
Fall 2007

Problem Set #3

Posted: Friday, Sept. 21, '07

Due: Friday, Sept. 28, '07

1. A second-order system has the step response shown below.¹ Determine its transfer function.



2. Consider again the system of a DC motor with a parallel current source connected via a gear pair to an inertia that we saw in Problem 5 of PS02. Substituting numerical values $i_s = 1.0u(t)$ A, $R = 5 \Omega$, $K_m = 0.5 \text{ N} \cdot \text{m}/\text{A}$, $K_v = 0.5 \text{ V} \cdot \text{sec}$, $J_m = 0.1 \text{ kg} \cdot \text{m}^2$, $(N_2/N_1) = 10$, $J = 6 \text{ kg} \cdot \text{m}^2$, $K = 1 \text{ N} \cdot \text{m}/\text{rad}$, derive and plot the step response for the following two cases:

a) $b = 9.4 \text{ N} \cdot \text{m} \cdot \text{sec}/\text{rad}$;

b) $b = 0.76 \text{ N} \cdot \text{m} \cdot \text{sec}/\text{rad}$.

3. Problem 8 from Nise textbook, Chapter 4 (page 234).

¹a.u. denotes arbitrary units; its use appropriate when we consider a function that does not correspond to any particular physical quantity.