

HW 1 – ME462 – Advanced Computer Control, due Thursday Sept. 4 by 3:30pm on the course website.

Format: all text must be handwritten and all figures drawn by hand. Your name must appear in all MATLAB graphs.

Text 1 – Astrom: *Computer-Controlled Systems: Theory and Design, Third edition*, by K. J. Astrom and B. Wittenmark, Dover, 2011.

Text 2 – Franklin: *Digital Control of Dynamic Systems, Third edition*, by G. F. Franklin, J. D. Powell, and M. Workman, Addison-Wesley, 1997 and Ellis-Kagle Press, 2006 (corrected edition).

Text 4 – Bentsman: *Signals, Instrumentation, Control, and Machine Learning: an Integrative Introduction*, World Scientific Publishing, 2022 (not 2016).

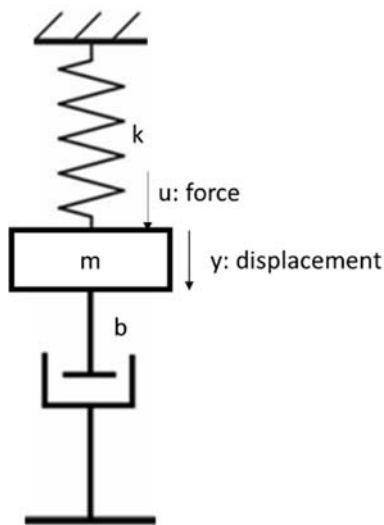
Text 1 – read Chapters 1 and 2, look through Appendices A and B;

Text 2 - read Chapters 1 through 7 at you own pace, look through Appendices A through D.

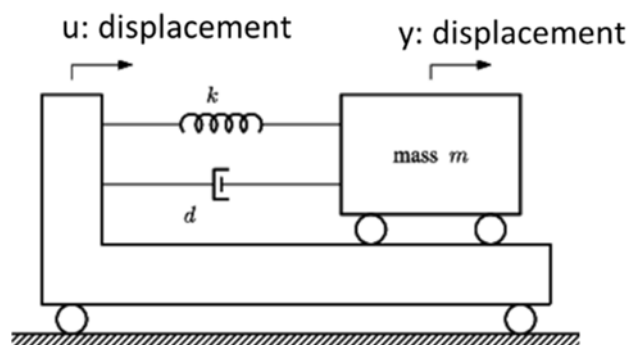
Text 4 – Review Chapters 3-6. Read Appendices G and H.

Solve the following problems.

For two CT mechanical systems:



System a



system b

- 1) Obtain the state-space and the transfer function descriptions.
- 2) Derive the general solution for an initial condition x_0 .
- 3) Select your own numerical values of the components and compute 1 and 2 with those values.
- 4) Obtain the unit step response for both systems analytically, compute the unit step response numerically using MATLAB, and compare the two to make sure they are the same. Provide your MATLAB code.
- 5) Select a reasonable sampling rate and derive analytically ZOH DT state-space and transfer function descriptions for each system

- 6) For DT system obtained in 5, compute the unit step response numerically. Provide MATLAB code.