

# SYSTEMS AND CONTROL - AE 315, 231

Week 2: Assignment No. 2 (Due Date: Sunday 10 September 11:59 p.m.)  
King Fahd University for Petroleum and Minerals - Aerospace Dept.

September 4, 2023

## Assignment Instructions

1. Attempt all the presented questions for partial grades.
2. Deliverables:
  - (a) The **MATLAB script** (.m) file.
  - (b) A **report** showing your work (.pdf). Please stick to the formal report format (cover page, table of contents, introduction, ...)
  - (c) Name your files according to this format: AE\_315\_Your\_Name\_HW\_#. (pdf/m)

## 1 Mass spring damper system

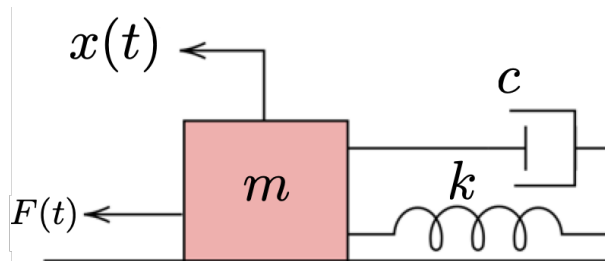


Figure 1: Mass spring damper system

1. (3 points) Starting with Newton's second law, derive the equation of motion governing the system shown in figure 1.
2. (3 points) Reduce the second order equation found in point 1 to be system of first order ODEs.
3. (3 points) Write a MATLAB code to simulate the equations found in 2. Use  $m = 3$  Kg,  $c = 20$  Ns/m,  $k = 800$  N/m, and assume the following scenarios for the deriving forces:
  - (a)  $F(t) = 0$
  - (b)  $F(t) = c$ ; where  $c$  is the last two digits of your ID number e.g. 2020168xx. If your last two digits are zeros, choose 25.
  - (c)  $F(t) = e^{-t} \sin t$
4. (1 point) Compare your findings with plots for each scenario and report all of your findings, code, and derivations in a neat way.