EE 521: Homework 1

1. Use MATLAB or Octave to generate the step response of second-order systems that are

   (a) underdamped,
   (b) critically damped, and
   (c) overdamped.

2. Given two different sensors with different characteristics that measure the same physical quantity. One sensor has a low-pass behavior while the other has a bandpass one. It is desired to blend the output of these two sensors in order to increase the dynamic range of the entire system. Discuss the challenges that you may face in doing so, e.g., the effect of the different magnitude and phase responses of the two sensors and how they will affect the blending process. Use figures and illustrations in your discussion.

3. For an op-amp define the following terms

   (a) open-loop gain,
   (b) close-loop gain,
   (c) loop gain,
   (d) stability, and
   (e) bandwidth.

4. Solve problem 1.2 from Northrop.

5. Derive the transfer function of a practical differentiator.