

**Homework #7**  
EMA 545, Spring 2013

**Problem 1: (20 pts)** Use FFT techniques to find the response of your vibration isolation system to the turbulent flight profile in “FlightAccel.mat” on the course website. (To do this, you will have to assume that the aircraft experiences this exact same flight profile over and over again.)

- a.) Provide at least one plot comparing the response of the aircraft to the (hopefully improved) response on the vibration isolator.
- b.) Report on the values of mass, stiffness and damping that you used and how they would be realized in practice (e.g. if you use a beam as a leaf spring, what would its dimensions be?).

**Problem 2: (20 pts)** Do **Problem 3.60** as given in the text. Comment on how you selected adequate values for  $N$  (number of samples in the time history) and the length of the time window (in seconds).

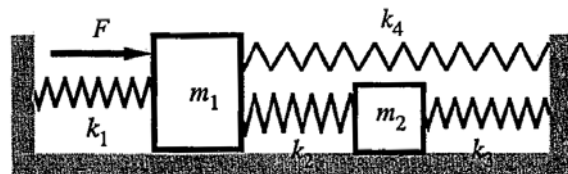
**Problem 3: Exercise 1.11** from Ginsberg. (For the proof described in (b), set  $m_2=0$  and see what your equation of motion reduces to.)

**1.11** When the system in the sketch is at its static equilibrium position, there is no axial force in each spring.

(a) Derive equations of motion for the horizontal displacements  $x_1$  and  $x_2$  measured from the equilibrium position.

(b) Prove that if  $m_2 = 0$ , the equation of motion for  $x_1$  is the same as that obtained by replacing the four springs by a single equivalent spring. Identify the way in which the springs are connected—for

example, series or parallel—according to the equivalent spring stiffness.



**EXERCISE 1.11**