Scientific Programming
Homework 2: Due 9/7

Practice problems (not to be turned in) Chapter 3 in the book: 4, 6, 16 and chapter 4: 2 (don't use the `fplot` command), 8

Homework problems Do not just turn in the answers to the following problems, show the exact Matlab commands you used to find the answer.

1. Consider the following chemical reaction (which happens to be oxidation of the amino acid cysteine):

$$a\ C_3H_{17}NO_2S + b\ O_2 \rightarrow c\ CO_2 + d\ H_2O + e\ NO_2 + f\ SO_2$$

   where the coefficients a, b, c, d, e and f are the number of each molecule involved in the reaction. The number of each atom must be the same on each side of the reaction. This gives a single equation balancing out each type of atom. For example, balancing oxygen(O) yields the equation $2a + 2b = 2c + d + 2e + 2f$. First write down the equation for each of the other elements. There are a total of 5 equations (one each for carbon, hydrogen, nitrogen, oxygen and sulfur) involving 6 unknowns. Normally this cannot be solved, but if you add in the equation $a = 1$ the system can be solved. Use Matlab to solve these equations and balance the chemical reaction.

2. The vibrations of the body of a helicopter due to the periodic force applied by the rotation of the rotor blade can be modeled by the following equations:

$$x(t) = \frac{2f_0}{\omega_n^2 - \omega^2} \sin\left(\frac{\omega_n - \omega}{2}t\right) \sin\left(\frac{\omega_n - \omega}{2}t\right)$$

   where $x(t)$ is how much the body of the helicopter is moved, f_o is the maximum force exerted by the blades, ω is the frequency of rotation of the rotor blades and ω_n is the natural frequency of the helicopter. The vibration is worst when ω and ω_n are close together. Assuming that $f_0 = 12$, $\omega = 12$ and $\omega_n = 10$, plot $x(t)$ as a function of t for $0 \le t \le 10s$. (Do not use the `fplot` command.)