ME 4189 Spring 2016
Homework assignment #1
Due on Thursday 01/21/2015

Learning objectives

Please study your class notes and the corresponding sections of the textbook before completing the assignment. .After completing this assignment, you should be able to:

- Determine the effective stiffness coefficient
- Apply the complex notation to express complex numbers
- Analyze harmonic motion
- Find the natural frequency of 1-dimensional systems

Solve the following problems of the textbook:

- 1.31
- 1.76
- 1.82
- 1.97
- 2.7

For each problem, you need to show your work and circle your final answer. Please staple your homework.

1.31 Derive the expression for the equivalent spring constant that relates the applied force F to the resulting displacement x of the system shown in Fig. 1.86. Assume the displacement of the link to be small.

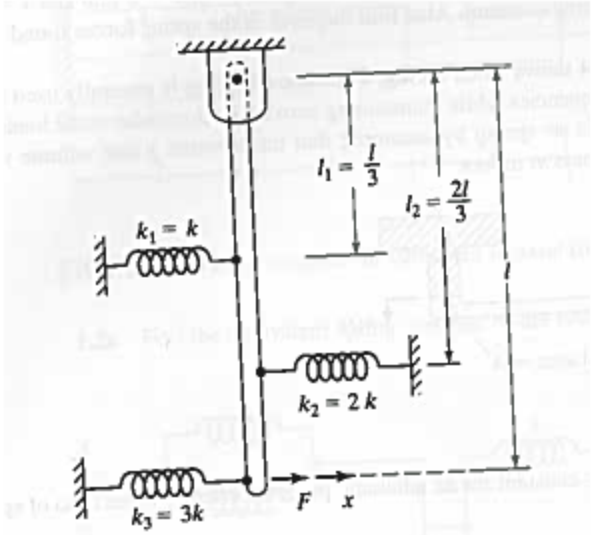

FIGURE 1.86 Rigid bar connected by springs.

1.76 Add the two complex numbers $(1 + 2i)$ and $(3 - 4i)$ and express the result in the form $Ae^{i\theta}$.

1.82 A machine is subjected to the motion $x(t) = A\cos(50t + \alpha)$ mm. The initial conditions are given by $x(0) = 3$ mm and $\dot{x}(0) = 1.0$ m/s.

a. Find the constants A and α.

b. Express the motion in the form $x(t) = A_1 \cos \omega t + A_2 \sin \omega t$, and identify the constants A_1 and A_2.

1.97 Express the vibration of a machine given by $x(t) = -3.0 \sin 5t - 2.0 \cos 5t$ in the form $x(t) = A\cos(5t + \phi)$.

2.7 Three springs and a mass are attached to a rigid, weightless bar PQ as shown in Fig. 2.51. Find the natural frequency of vibration of the system.

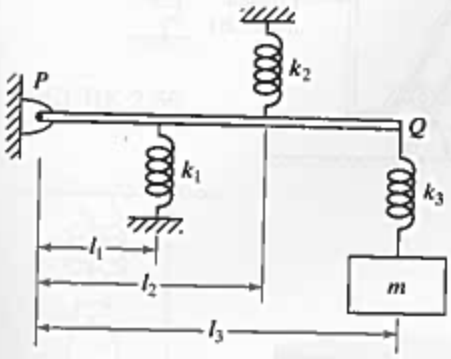

FIGURE 2.51