1 SPRING RATE

IMPORTANT: *Use IPS units for ALL answers on this assignment. Include units on ALL answers. SolidWorks gives mass in units of pounds.*

1. What are the Young's Modulus and Shear Modulus of Plain Carbon Steel in IPS units?

Property	Value	Units
E	30457924.91	psi
G	11457981.28	psi

2. What is the calculated spring rate k using the analytical equation?
   k = 71.26 [lb/in]
3. What is the resultant reaction force on the end of the spring from the simulation?
   Fr = 1.47 lbs.
4. What is the spring rate k found using the Finite Element Method?
   k = 73.5 lb/in
5. Assuming the FEM solution is correct, what is the %error of our analytical solution?
   error = 3.04%
6. Fill in the mass (in pounds) and density values below:

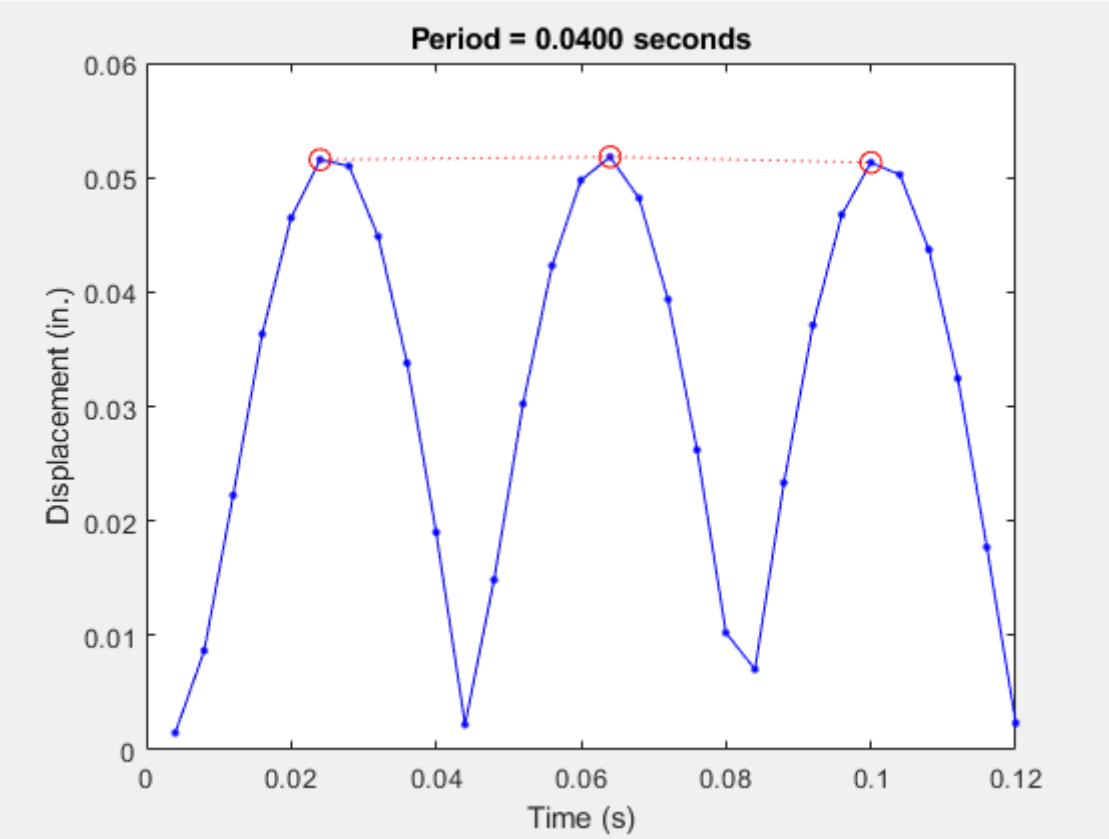
	Value	Units
Spring mass	0.3343	pounds
Material density	0.2818	pounds / in^3

2 MODAL ANALYSIS

1. What is the calculated mass of the sphere in pounds?
   m = 3.9838 lbs.
2. Using the Mass Properties tool, what is the mass of this configuration (with the sphere) minus the mass of the previous configuration?
   m = 3.9834 lbs.
3. What is the calculated natural frequency of the system in Hz? - watch your units!
   f = 4.3 Hz.
4. What is the frequency of the axial stretching and compression mode of the spring mass system found using SolidWorks Frequency analysis?
   f = 13.407 Hz.
5. What is the frequency associated with the rotation of the sphere?
   f = 12.655 Hz.

3 NONLINEAR DYNAMIC STUDY

1. What advantages does the Eigenvalue Frequency study have over the Nonlinear Dynamic study?
   the eigenvalue frequency study is a more accurate method of determining frequency.
2. What advantages could the Nonlinear Dynamic study have over the Eigenvalue Frequency study?
   Although the eigenvalue frequency is a better method for the solution, the nonlinear dynamic model requires less parameters to solve the problem thus allowing a faster run time than the eigenvalue frequency.
3. Paste the plot of your simulated spring-mass system displacement using the provided Matlab code (label your axes):



4. What is the roughly estimated frequency of this system and how does it compare with the value obtained using modal analysis?
   The estimated frequency is 1/P so f = 25. It is a higher frequency, roughly double that from the modal analysis.