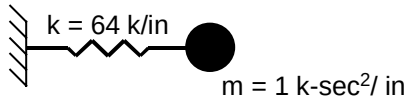
Problem Y

Response Spectrum Analysis For Single Degree of Freedom System

System

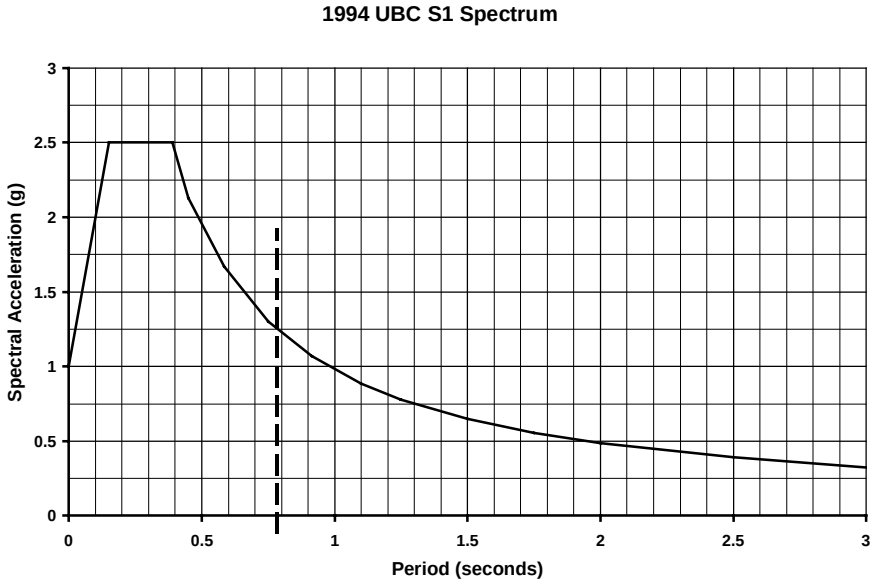


To Do

Perform a response spectrum analysis of this single degree of freedom system using the built-in 1994 UBC S1 spectrum. Compare the period with the calculated period below. Compare the spring force with the response spectrum below.

$$T = 2\pi\sqrt{\frac{m}{k}} = 2\pi\sqrt{\frac{1}{64}} = 0.7854 \text{ seconds}$$

Note: $1.25 \text{ g} * \frac{386.4 \text{ in/sec}^2}{1 \text{ g}} = 483 \text{ in/sec}^2$



Note: Our intent is that you try this problem on your own first. After you have solved it on your own, you can step through our solution if desired. If you have problems trying to create the model, then follow the steps in our solution.

Problem Y Solution

1. Click the drop down box in the status bar to change the units to kip-in. 

2. From the **File** menu select **New Model…**. This displays the Coordinate System Definition dialog box.
3. In this dialog box
   - Select the Cartesian Tab.
   - In the Number of Grid Spaces area type **0** in the X direction edit box.
   - In the Number of Grid Spaces area type **0** in the Y direction edit box.
   - In the Number of Grid Spaces area type **0** in the Z direction edit box.
   - Click the **OK** button.
4. Click the "X" in the upper right-hand corner of the window labeled 3-D View to close it.
5. Click the **Draw Special Joint** button  on the side toolbar or select **Add Special Joint** from the **Draw** menu.
6. Click on the grid intersection at the origin to enter a joint.
7. Click the **Pointer** button  to exit Draw Mode and enter Select Mode.
8. Select the joint by clicking on it.
9. From the **Assign** menu select **Joint** and then **Springs…** from the submenu to display the Joint Springs dialog box.
10. In this dialog box:
    - Type **64** in the Translation 1 edit box.
    - Click the **OK** button.
11. Select the joint by clicking on it.
12. From the **Assign** menu select **Joint** and then **Masses…** from the submenu to display the Joint Masses dialog box.
13. In this dialog box:
    - In the Masses in Local Directions area type **1** in the Direction 1 edit box.

- Click the **OK** button.

14. From the **Define** menu select **Response Spectrum Cases…** to display the Define Response Spectra dialog box.

15. In this dialog box:

    - Click the Add New Spectra button to display the Response Spectrum Case Data dialog box.

    - In this dialog box:

        - Accept the default Spectrum case name, SPEC1.

        - Accept the default Excitation Angle, 0.

        - Accept the default Modal Combination option, CQC.

        - Type **.05** in the Damping edit box.

        - Accept the default Directional Combination option, SRSS. Note that this option is irrelevant in this example since the response spectrum is run in only one direction.

        - In the Input Response Spectra area select UBC94S1 from the U1 Function drop-down box.

        - In the Input Response Spectra area type 386.4 in the U1 Scale factor edit box.

        - Click the **OK** button twice to exit all dialog boxes.

16. From the **Analyze** menu select **Set Options...** to display the Analysis Options dialog box.

    - Uncheck all of the Available DOFs check boxes except for UX.

    - Verify the the Dynamic Analysis check box is checked.

    - Click the **Set Dynamic Parameters** button to display the Dynamic Analysis Parameters dialog box.

    - In this dialog box:

        - Verify that the Number of Modes is 1.

        - Verify that the Eigenvectors option is selected in the Type of Analysis area.

        - Click the **OK** button twice to exit all dialog boxes.

17. Click the **Run Analysis** button  to run the analysis.

18. When the analysis is complete check the messages in the Analysis window (there should be no warnings or errors) and then click the **OK** button to close the Analysis window. Note that the 3-D window now shows the first mode shape.

19. Note that the period is reported in the window title. It should be 0.7854 seconds.

20. From the Display menu select Show Element Forces/Stresses and then Joints… from the submenu to display the Joint Reaction Forces dialog box.

21. In this dialog box:

    - Select SPEC1 Spectra from the load drop-down box.
    - In the Type area select the Spring Forces option.
    - Click the **OK** button.

22. If the axes make it difficult to read the spring force, then from the **View** menu select **Show Axes** to toggle the axes display off.