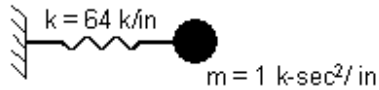


Problem Y

Response Spectrum Analysis For Single Degree of Freedom System

System

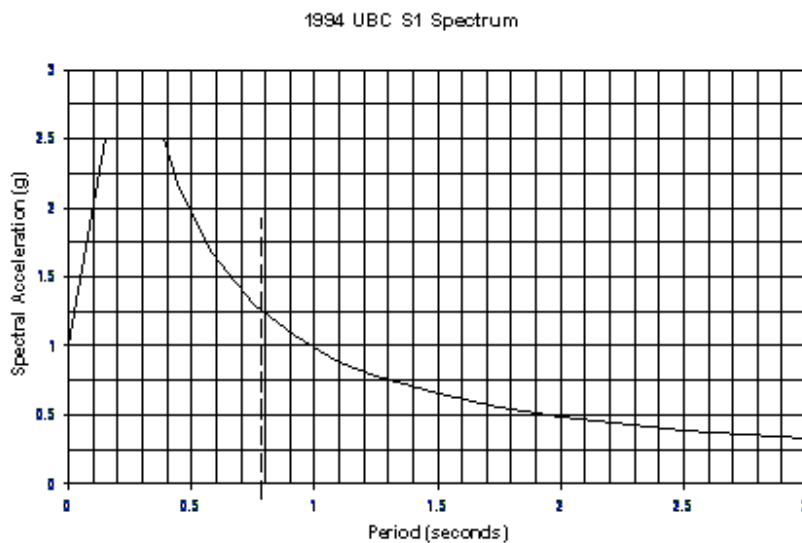


To Do

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.

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

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

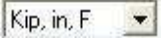


CSI Solution Demonstrates Use of These Features

- Draw Special Joint
- Dynamic Analysis
- Mode Shapes
- Response Spectrum Analysis

Problem Y Solution

1. Click the **File menu > New Model** command to display the **New Model** form.

2. Verify that the units shown in the status bar are .



3. Click on the **Grid Only** button to display the **New Coord/Grid System** form. In that form:

- Select the *Cartesian* Tab.
- In the *Number of Grid Lines* area, type **1** in the *X direction* edit box.
- In the *Number of Grid Lines* area, type **1** in the *Y direction* edit box.
- In the *Number of Grid Lines* area, type **1** 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 or the **Draw menu > Draw Special Joint** command to display the **Properties of Object** form.

6. Click on the axes intersection at the origin to enter a joint.



7. Click the **Set Select Mode** button to exit Draw mode and enter Select mode.

8. Select the joint by clicking on it.

9. Click the **Assign menu > Joint > Springs** command to display the **Joint Springs** form. In that form:

- Type **64** in the *Translation 1* edit box.
- Click the **OK** button.


10. Select the joint by clicking on it.

11. Click the **Assign menu > Joint > Masses** command to display the **Joint Masses** form. In that form:

- In the *Masses in Local Directions* area type **1** in the *Direction 1* edit box.
- Click the **OK** button.

12. Click the **Define menu > Functions > Response Spectrum** command to display the **Define Response Spectrum Functions** form. In that form:

- In the *Choose Function Type to Add* area, select the *UBC94 Spectrum* from the drop-down list.
- Click the **Add New Function** button to display the **Response Spectrum UBC 94 Function Definition** form. In that form:
 - Type **SPEC1** in the *Function Name* edit box.

- In the *Parameters* area type **1** in the *Seismic Zone Factor, Z* edit box. This variable is being scaled up in excess of the required code value to give a peak ground acceleration of 1g.
 - Select 1 from the *Soil Type* drop-down list.
 - Click the **OK** buttons on the ***Response Spectrum UBC 94 Function Definition*** and ***Define Response Spectrum Functions*** forms to exit all forms.
13. Click the **Define menu > Analysis Cases** command to display the ***Analysis Cases*** form. In that form:
- Click the **Add New Case** button to display the ***Analysis Case Data*** form. In that form:
 - Type **RS** in the *Analysis Case Name* edit box.
 - In the *Analysis Case Type* area, select *Response Spectrum* from the drop-down list.
 - Accept the default *Modal Combination* option, CQC.
 - 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 *Loads Applied* area:
 - Verify that *U1* is shown in the *Load Name* drop-down box.
 - Verify that *SPEC1* is shown in the *Function* drop-down box.
 - Type **386.4** in the *Scale Factor* edit box.
 - Click the **Add** button.
 - Verify that *Modal Damping* is set to *Constant at 0.05*.
 - Click the **OK** button.
 - Click on MODAL in the *Case Name* list to highlight it.
 - Click the **Modify/Show Case** button to display the ***Analysis Case Data - Modal*** form. In that form:
 - Verify that the *Eigen Vectors* option is selected in the *Type of Modes* area.
 - In the *Number of Modes* area, type **1** in the *Maximum Number of Modes* edit box.
 - Click the **OK** buttons on the ***Analysis Case Data - Modal*** and ***Analysis Cases*** forms to exit all forms.
14. Click the **Analyze menu > Set Analysis Options** command to display the ***Analysis Options*** form.
- Uncheck all of the *Available DOFs* check boxes except for UX.
 - Click the **OK** button.
15. Click the **Run Analysis** button  to display the ***Set Analysis Cases to Run*** form. In that form:

- Click the **Run Now** button.
16. When the analysis is complete, check the messages in the **SAP Analysis Monitor** window (there should be no warnings or errors) and then click the **OK** button to close the window. Note that the window now shows the first mode shape.

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

17. Click the **Display menu > Show Forces/Stresses > Joints** command to display the **Joint Reaction Forces** form. In that form:
 - Select *RS* from the *Case/Combo Name* drop-down list.
 - In the *Type* area, select the *Spring Forces* option.
 - Click the **OK** button.
18. If the axes make it difficult to read the spring force, click the **View menu > Show Axes** command to toggle the axes display off.