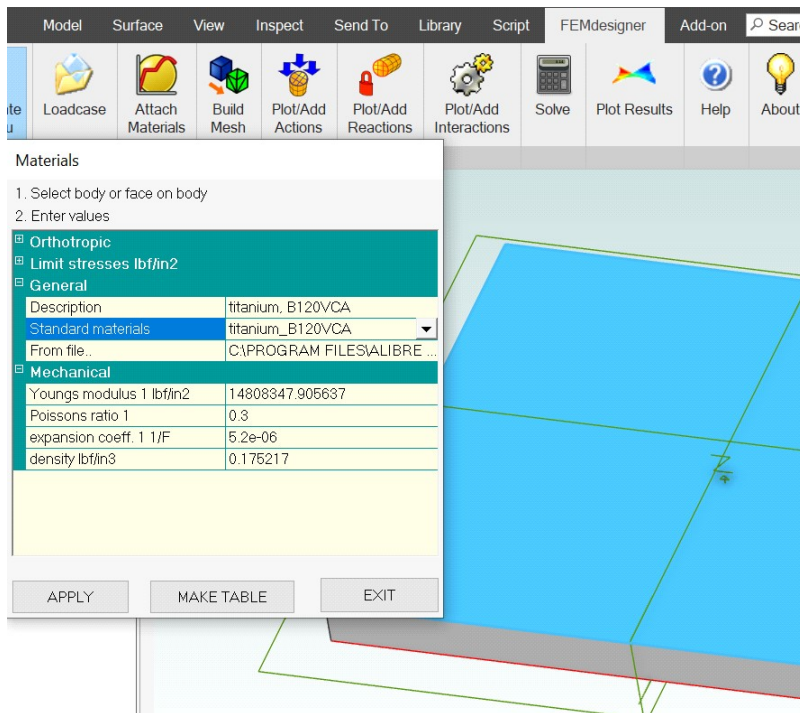


FEMdesigner AD: Natural Frequency Tutorial

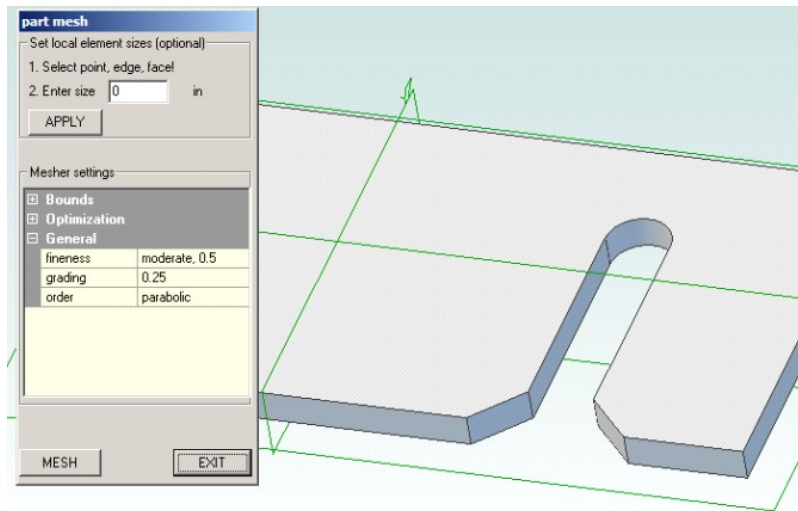
In this natural frequency tutorial, you will calculate the natural resonant frequencies and corresponding mode shapes of a slotted plate that is fixed at one end, then visualize these mode shapes as both a static shape and an animation. These frequencies and mode shapes will depend on the stiffness of the material, the shape of the part, and the restraints on the part. Refer to the ‘activated’ command bar below.



Open File and Assign Material

The corresponding zip file has an Alibre Design part file; Slot Plate.ad_prt. Unzip it to a suitable folder.

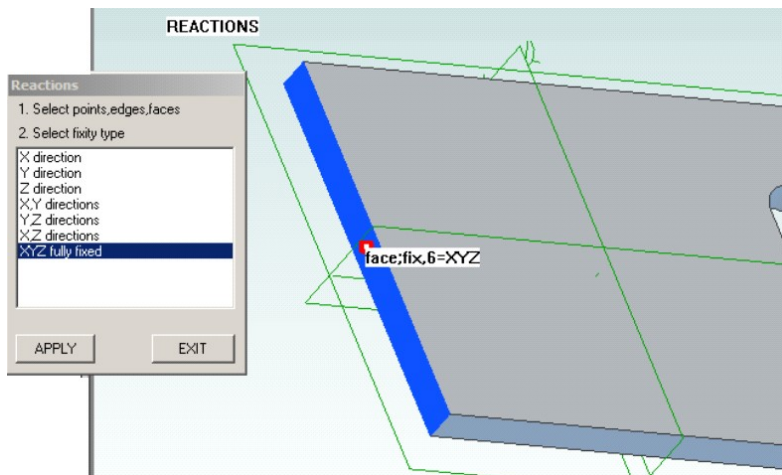
- Click on ‘Loadcase’ command button. Select ‘Create New Loadcase’, click ‘Apply’ and ‘Exit’.
- Click on ‘Attach Materials’ command and select any face.
- Select a material from the drop-down list and click ‘Apply’. The material will be displayed.
- Click ‘Exit’.



Create/View Mesh

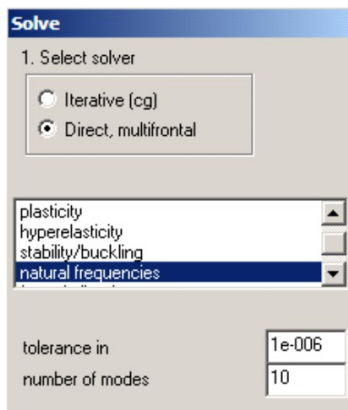
- Click on ‘Build Mesh’ command.
- Leave mesh settings at their default values.
- Click the ‘MESH’ button to bring up the progress dialog box which displays “Finished” when done.
- ‘EXIT’ both mesh dialog boxes.





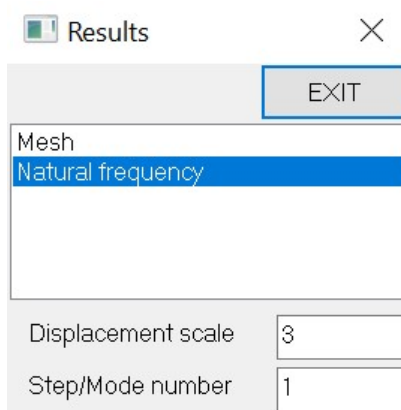
Constrain End Face

- No “Actions” (loads) are required.
- Select “Plot/Add Reactions”.
- Select “XYZ fully fixed”.
- Select the end face shown here.
- Click ‘APPLY’ to view the plot shown.
- Click ‘EXIT’.



Solve for Buckling

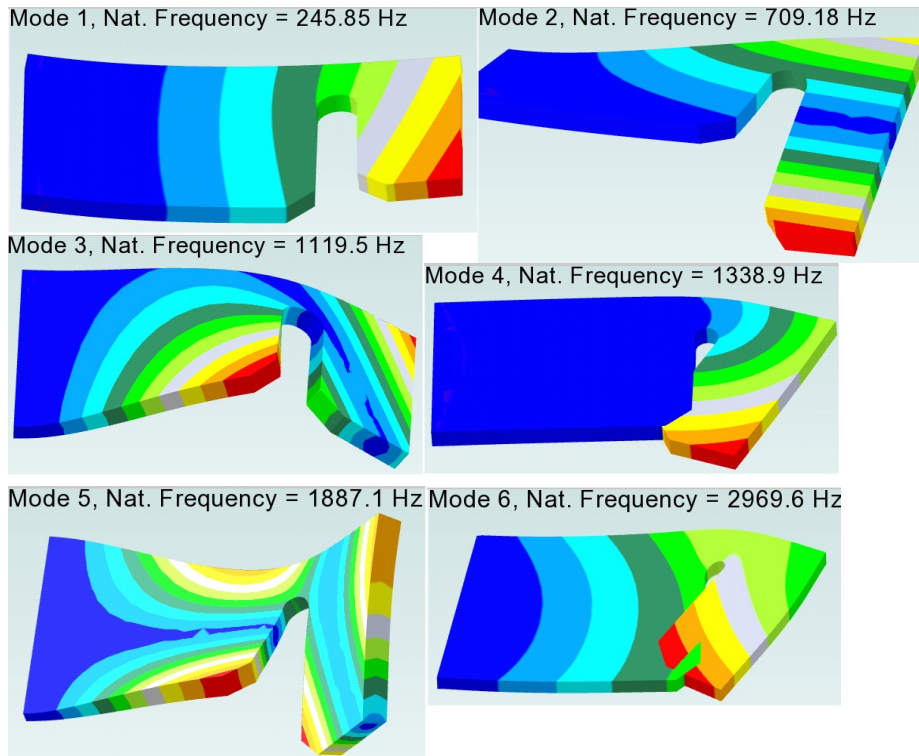
- Click ‘Solve’ command.
- Select ‘Direct’ and ‘natural frequencies’ in the dialog box. The iterative solver cannot be used for this type of analysis yet.
- Type 10 in the ‘number of modes’ box. This will calculate the first ten mode shapes and their corresponding natural frequencies for this part.
- Click on ‘SOLVE’. A status box with solver progress information appears.
- When the status box disappears, the solution is ready.



View Results

Click the ‘Plot Results’ command again to bring up the results dialog box.

- Enter the number 3 in the ‘Displacement scale’ box and select ‘Natural frequency’ from the results list.
- The natural frequency for each buckling mode is displayed on screen.
- Click the ‘Animate’, checkbox to see the buckling in motion. Unclick it to stop the animation.
- Enter 2 in the “Step/Mode number” box and re-click on the ‘Natural frequency’ selection. Repeat for modes 3 to 10.



The first 6 modes are shown on the left.

The fundamental natural frequency usually has a minimum value specified by the client to avoid vibrations. To increase this value you need to increase either stiffness or reduce mass. Damping has no effect on natural frequency. Sometimes you obtain a cluster of similar frequencies.

Note that the mesh could have been made 'Linear' rather than 'Parabolic' because stresses are not required so we can use a coarser mesh. This computationally helps offset the fact that for natural frequency calculations we usually need to mesh the entire body because modes are not always symmetric (as demonstrated above) even when the geometry is symmetric. Refine the mesh and test to ensure you have a value which is mesh independent.