MSC.Marc Mentat - Simulation of acoustic wave propagation

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The purpose of this lab is to practice performing transient simulations to analyze dynamic phenomena, using acoustic wave propagation as an example.
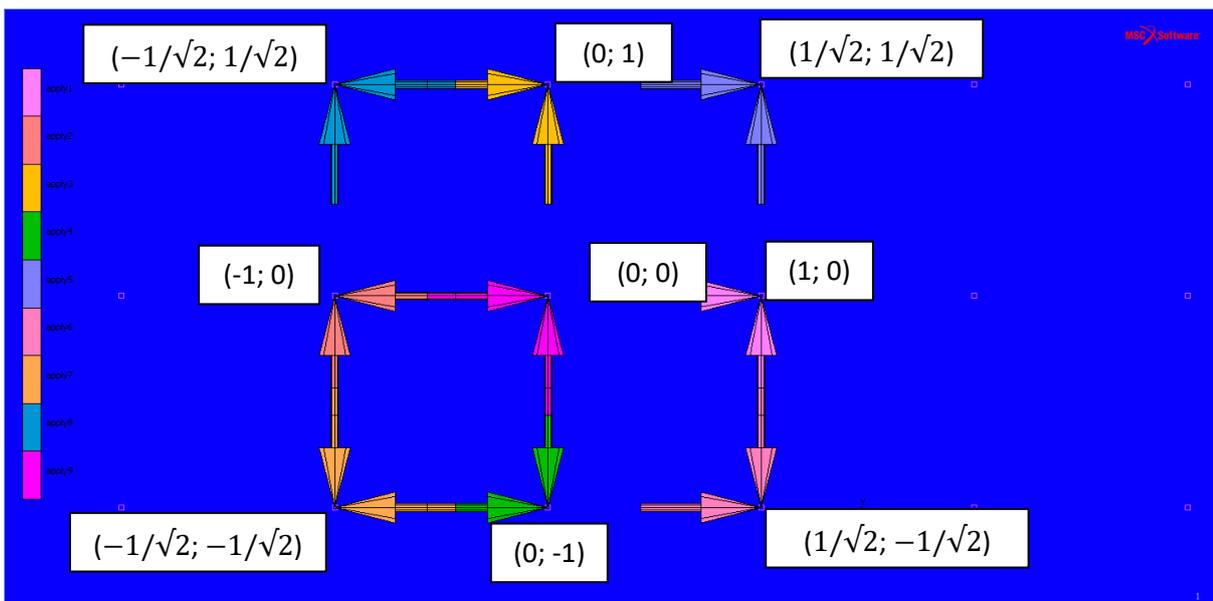
Test case no. 1

1. Create a 2D square plate with dimensions of 0.1 x 0.1 meters. Discretize this model using quadrilateral (**Quad 4**) elements with a size of 0.5 x 0.5 millimeters. Specify the material properties for aluminum.
2. Create an excitation signal in the time domain with a central frequency of 300 kHz, a sampling frequency of 10 MHz, and one cycle. See the example below. You can use MATLAB to create the signal. Once the excitation signal is created, copy the time and amplitude vectors into a .txt file and name it *excSignal_300kHz*, for example.
3. Assign a boundary condition of fixed displacement in the X or Y direction in the middle of the plate using the previously created signal.
4. Create a dynamic transient load case and run your simulation for 10 µs with a constant time step of 0.2 µs.
5. Once the simulation is finished, open the results and plot a history plot for the selected node.
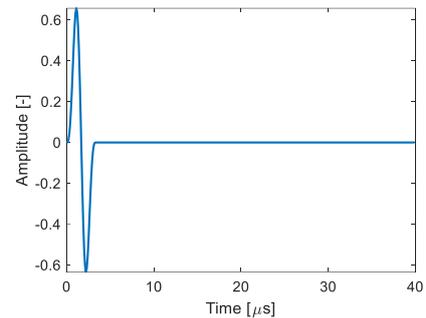
Test case no. 2

Repeat the test case no. 1 but apply the boundary conditions in a manner similar to that presented below.

Compare the results from task no. 1 with those from task 2.

Test case no. 3

Add another material or discontinuity to the previous model in the selected area and run the calculations. Then, compare the results and explain the differences.

Test case no. 4

Divide your model in half. For one of the halves, assume the material is water and perform the numerical calculations. Can you see any waves passing through the water layer?