HEXAGON

Forced Response of Coupled Plate and Cavity with Increased Structure Damping and Added Foam

Actran Student Edition Tutorial

Workshop description

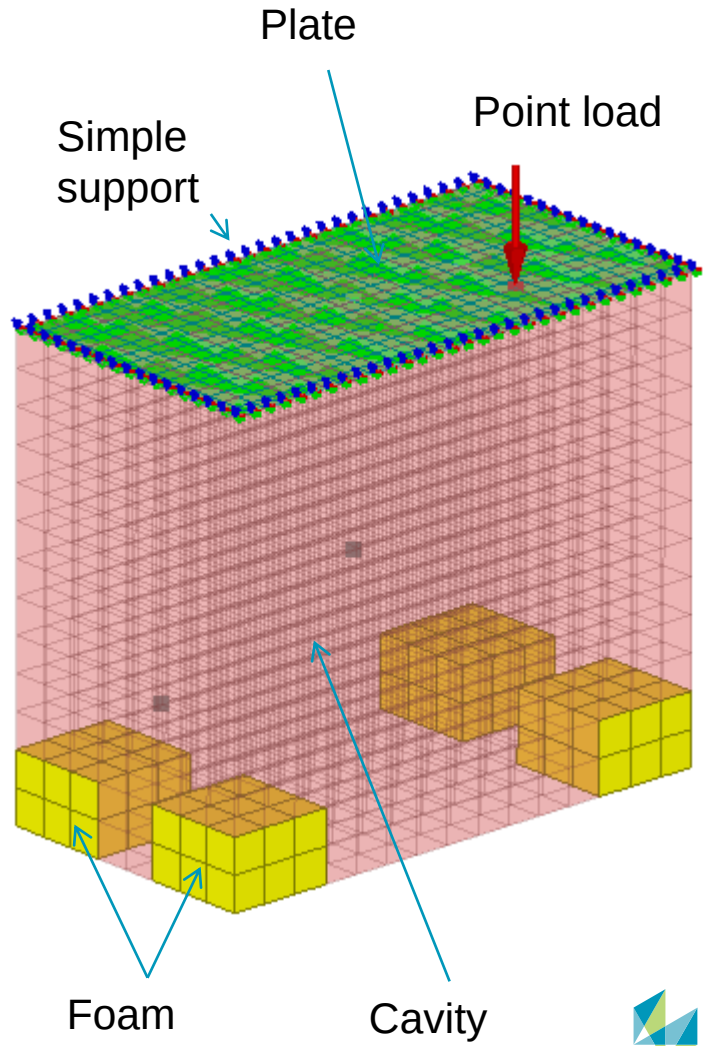
HEXAGON

Introduction

- This workshop demonstrates Actran capabilities to model high damping solid material and porous material
- The objectives of this workshop are the following :
  - Get introduced to modeling of porous materials in Actran
  - Evaluate the effectiveness of adding structure damping and foams in order to smooth the FRF responses on the plate and in the cavity
- Software version:
  - Actran 2021.1 Student Edition
- **Pre-requisites** - before going through this presentation, the reader should have read and understood the following presentation:
  - Workshops : Forced response of coupled plate and cavity

Workshop description

- The previously created plate / cavity coupled model is modified, in two different ways
  - A high damping factor is used for the solid material of the plate
  - Four foam blocks are put at the cavity's four lower corners
- The mechanical load, support condition, and field points positions remain the same as in previously built model

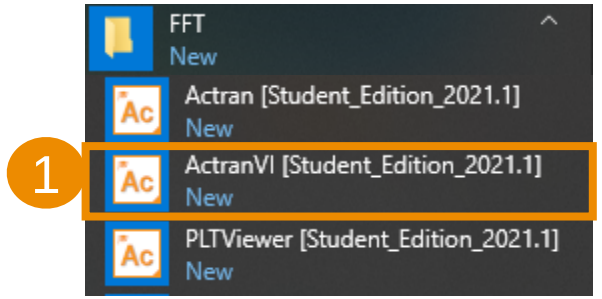


Workshop pre-processing

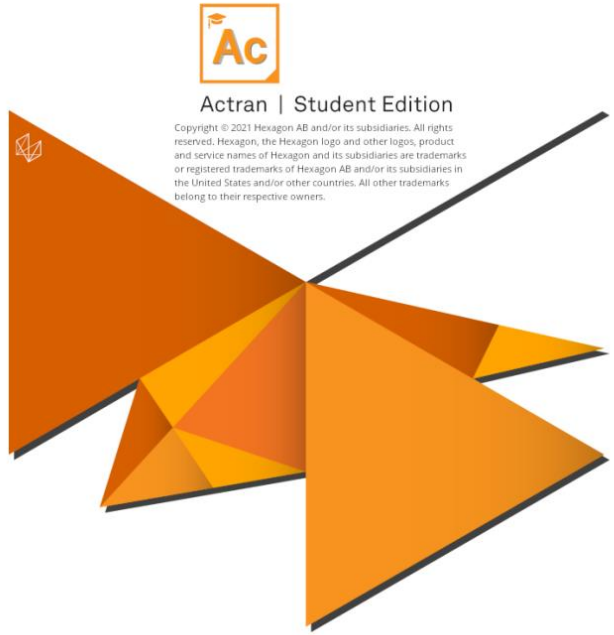
HEXAGON

Start ActranVI

- Start ActranVI:
  - Shortcut is available through the Windows Start Menu



(Windows Start Menu)

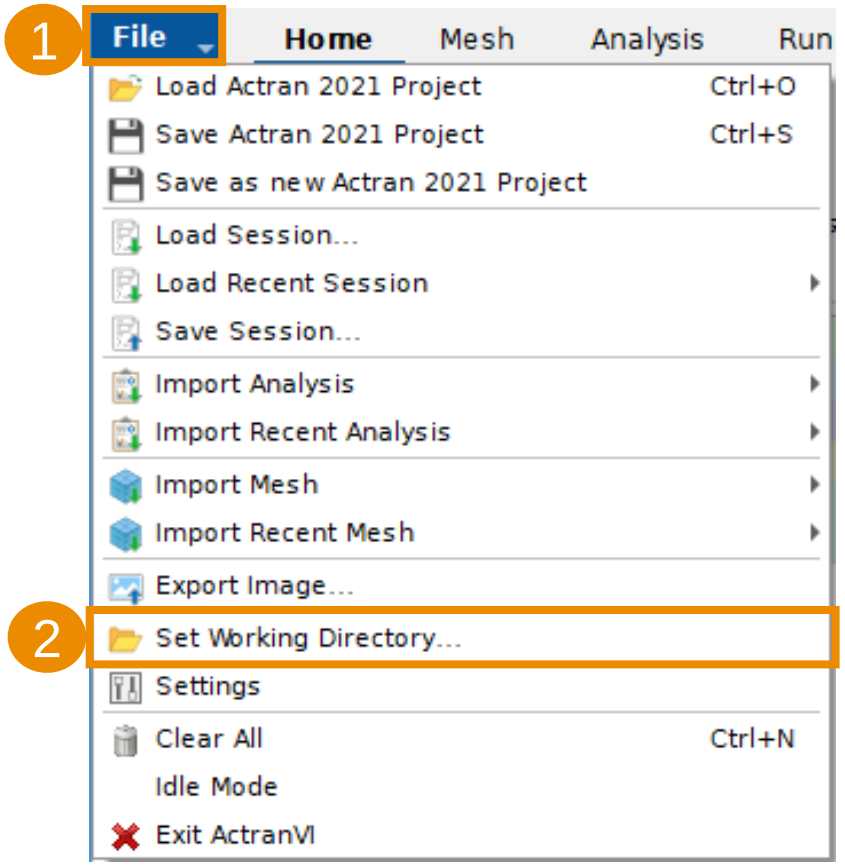


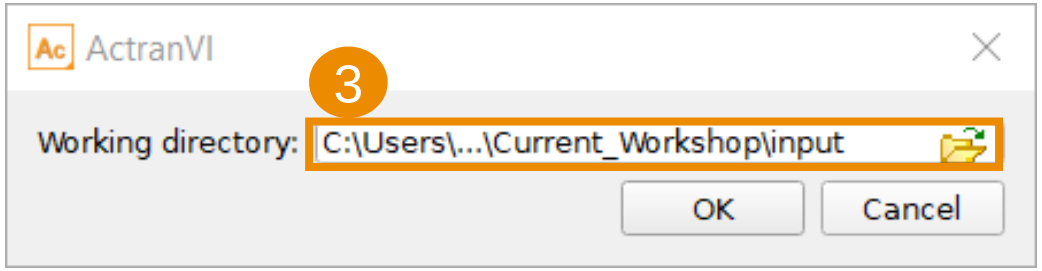
HEXAGON

Set the working directory

Select the workshop input directory as the working directory

- The working directory is the project directory where all ActranVI related files are output

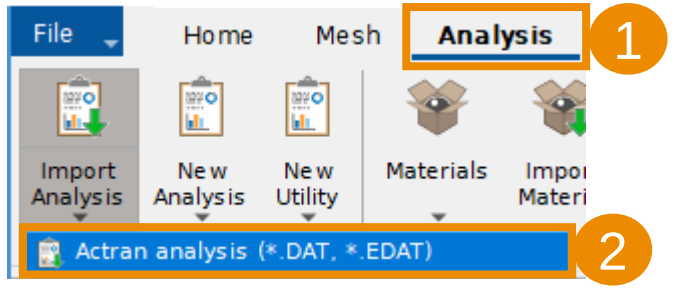


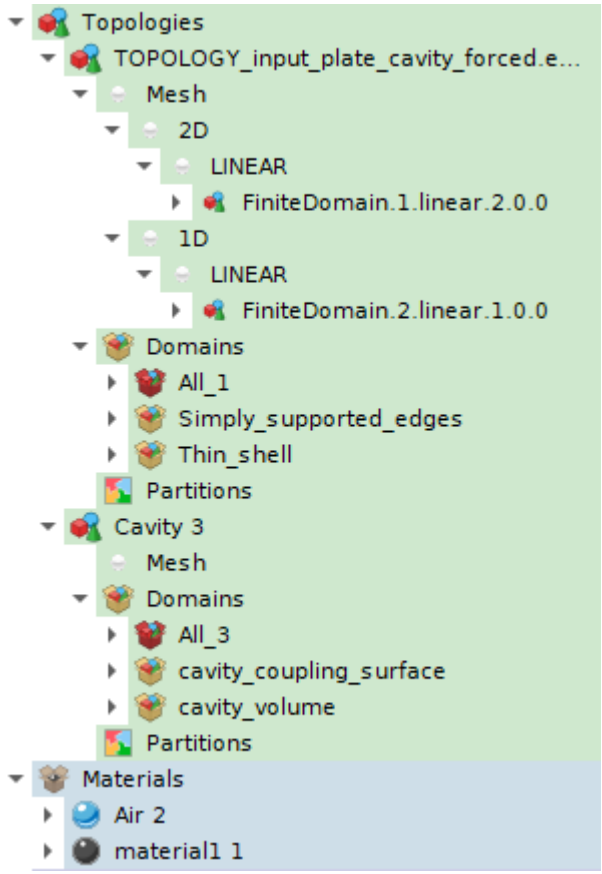


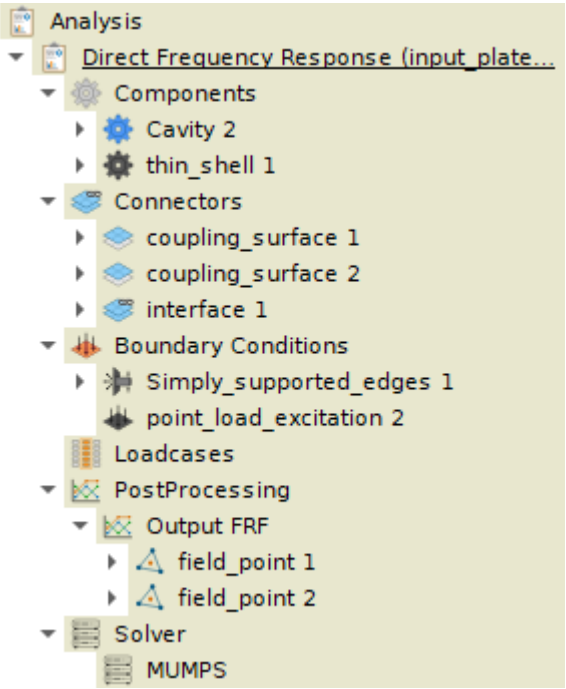
The working directory path should not contain any space or special character

Import the analysis of “Plate force response”

- Import the *input_plate_cavity_forced.edat* analysis







HEXAGON

Increase the damping of the plate material

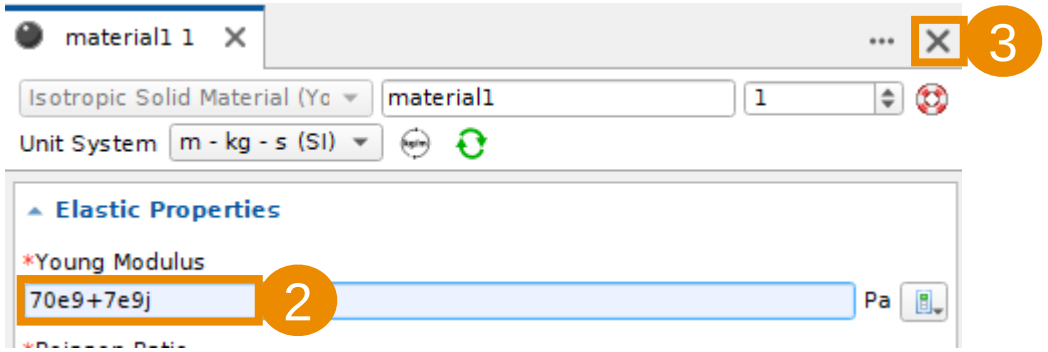
Open Property window of solid material

Change the Young's modulus imaginary part from $7*10^8$ to $7*10^9$

Close the window

1

Double click



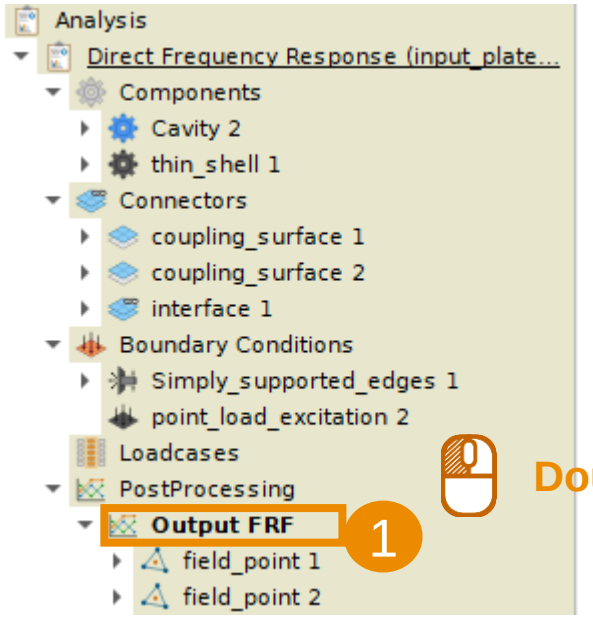
HEXAGON

Change the output file name

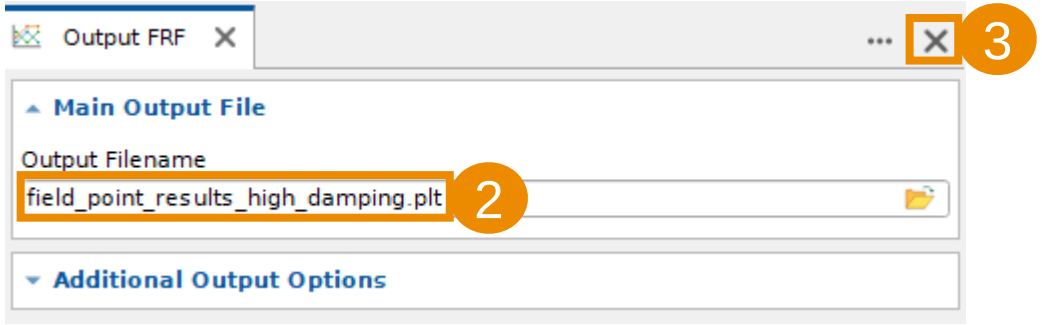
Open Property window of Output FRF node

Change the name of PLT file

Close the window



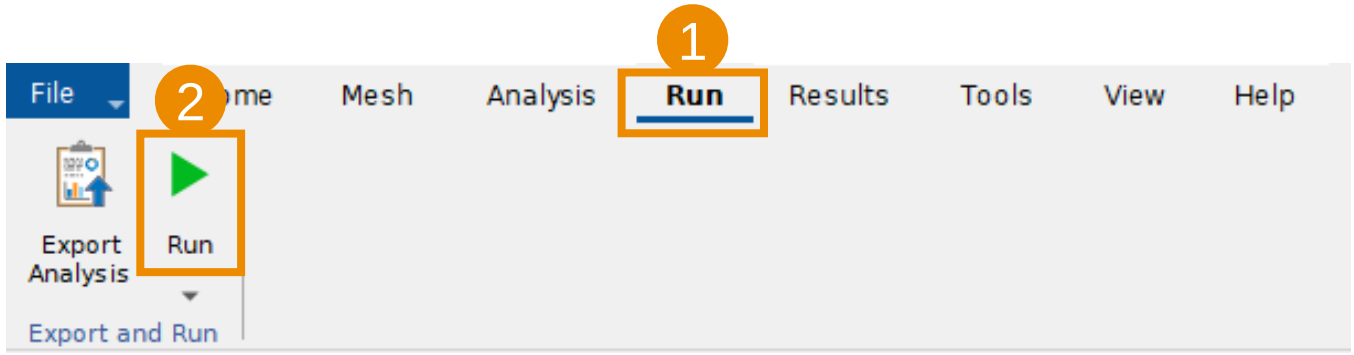
Double click



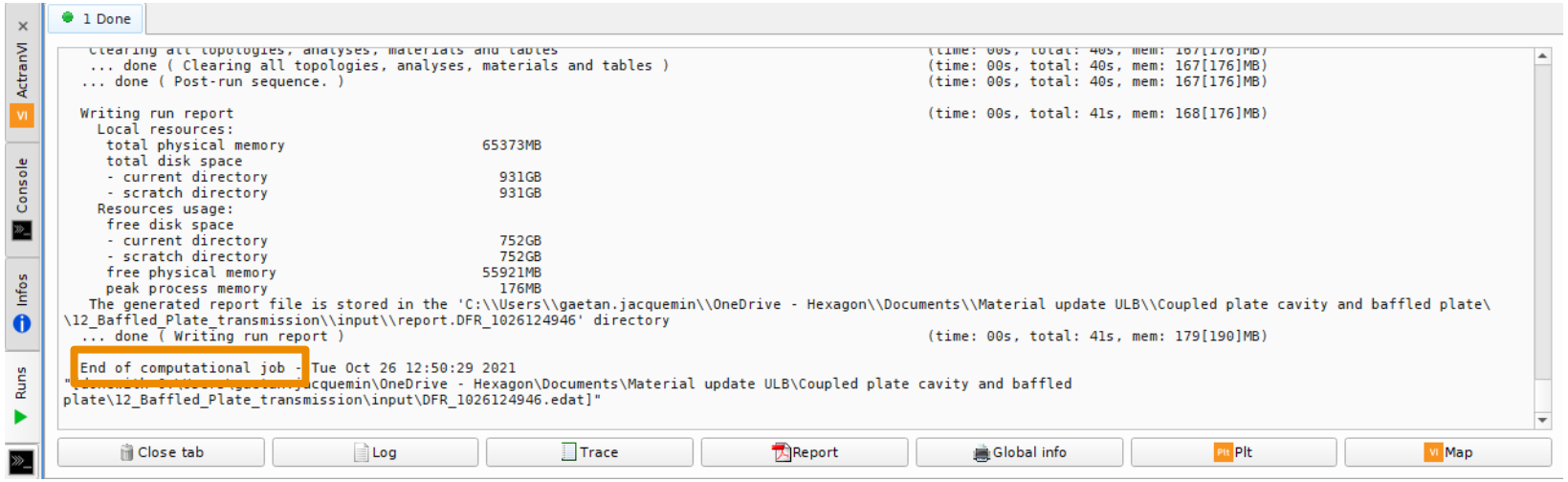
HEXAGON

Launch the Actran analysis in ActranVI

Launch the computation



Check the log showing the computation progress



HEXAGON

Reduce the damping of the plate material to its original value

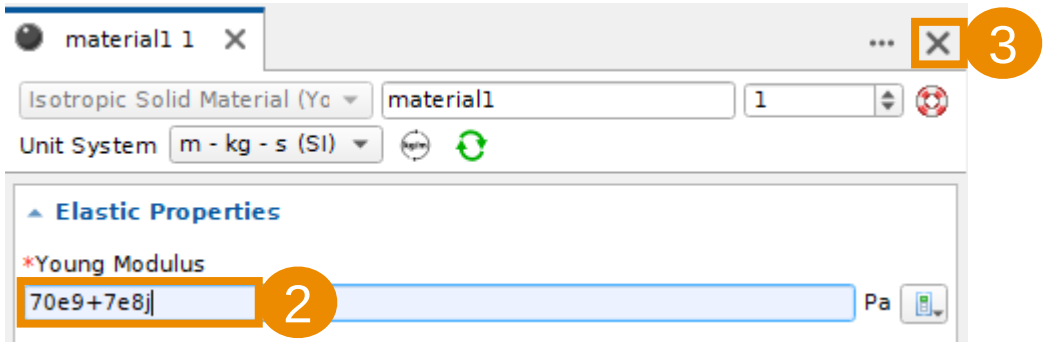
Open Property window of solid material

Change the Young's modulus imaginary part from $7*10^9$ to $7*10^8$ (original value)

Close the window

1

Double click



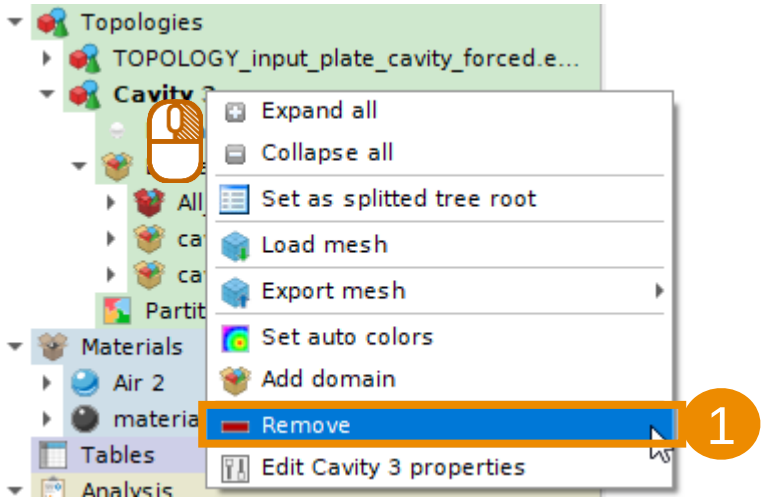
2

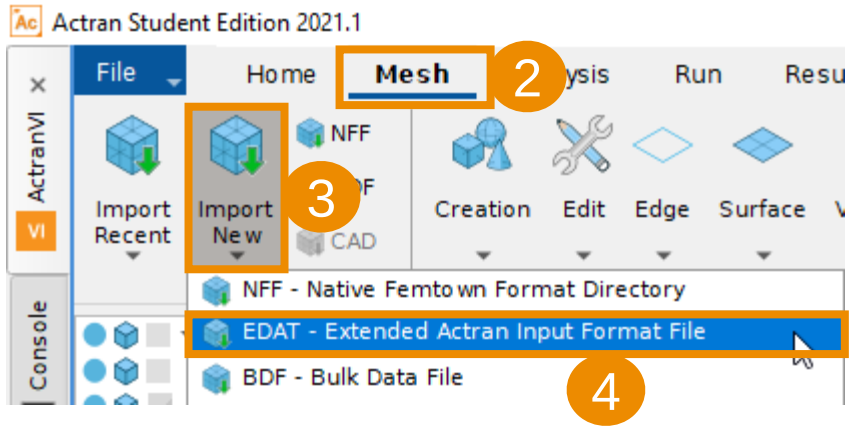
3

HEXAGON

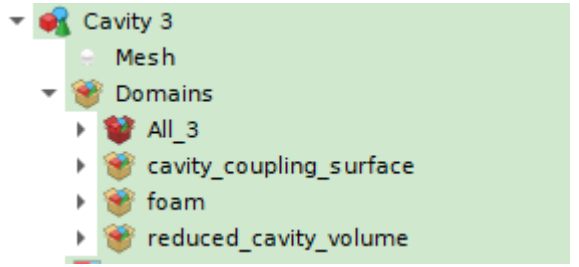
Update the cavity mesh

Remove the existing cavity mesh





Load the new mesh with foam parts *cavity_with_foam.edat*



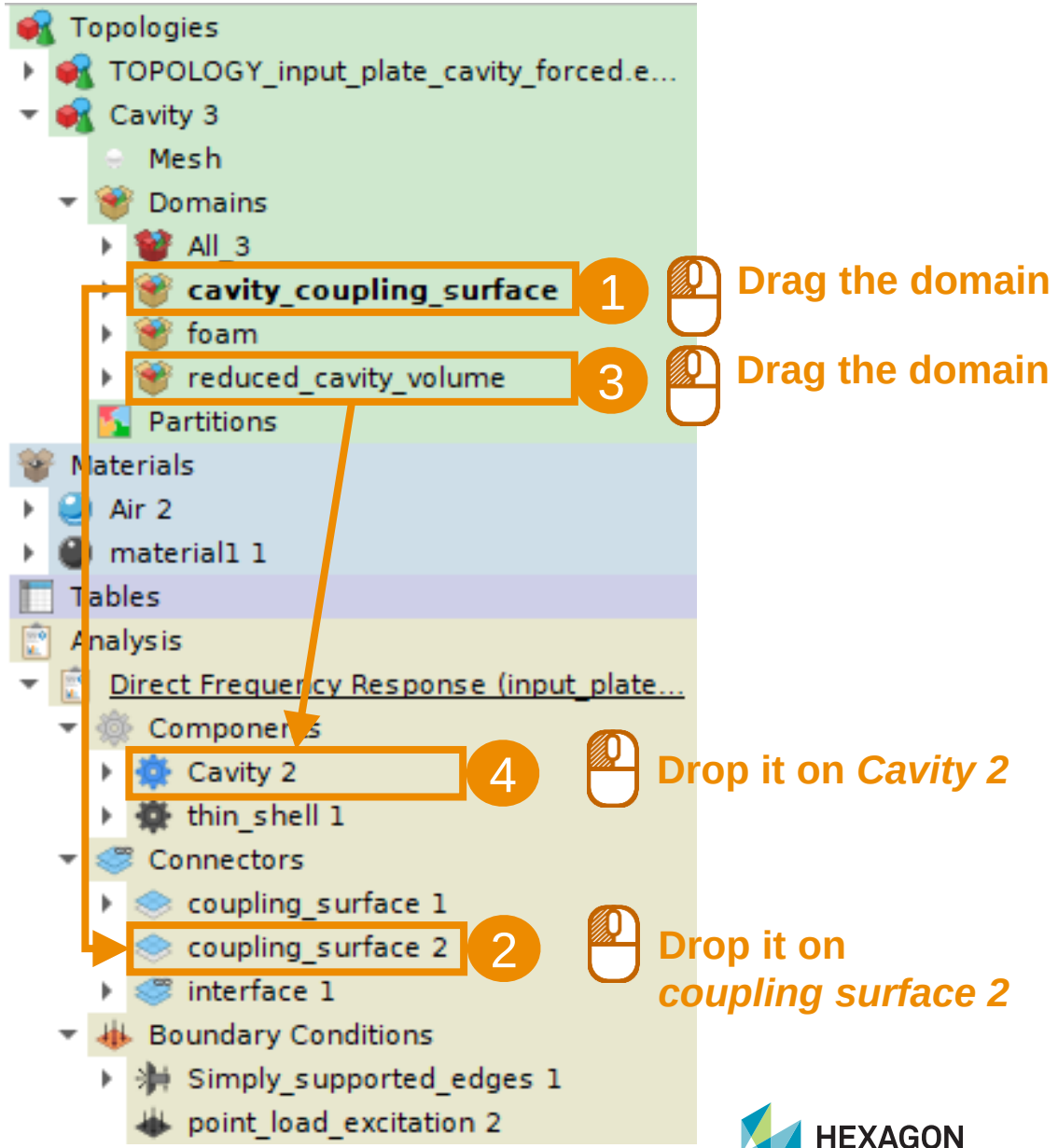
Check the topology

HEXAGON

Assign Cavity domains

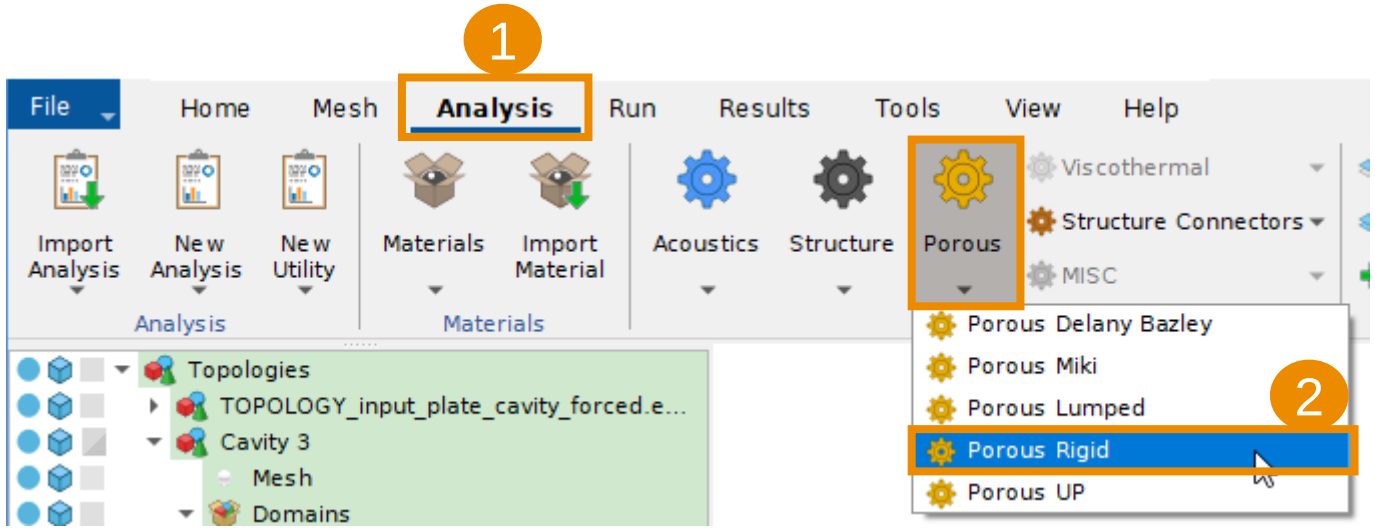
- As the cavity mesh was replaced, domains must be assigned to the components that are already defined in the analysis
- To assign the domains to the components directly from the topological tree, select a domain by left clicking on it and then, without releasing the button drag it to the corresponding component (drag & drop)
- Once the domain is assigned to a component it can be seen in the “Scope” of the component

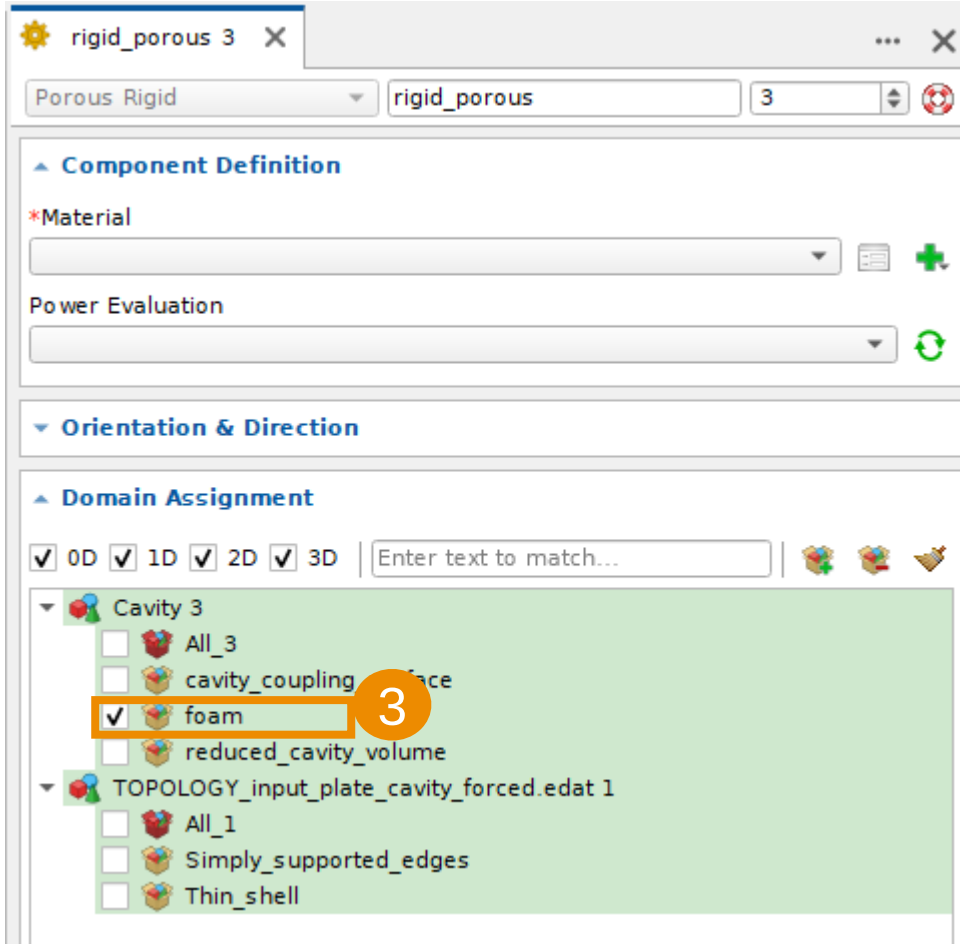
- Assign the domain cavity_coupling_surface to the coupling_surface_2 component
- Assign the domain reduced_cavity_volume to the cavity_2 component



HEXAGON

Create a Porous Rigid component for the foam (1)



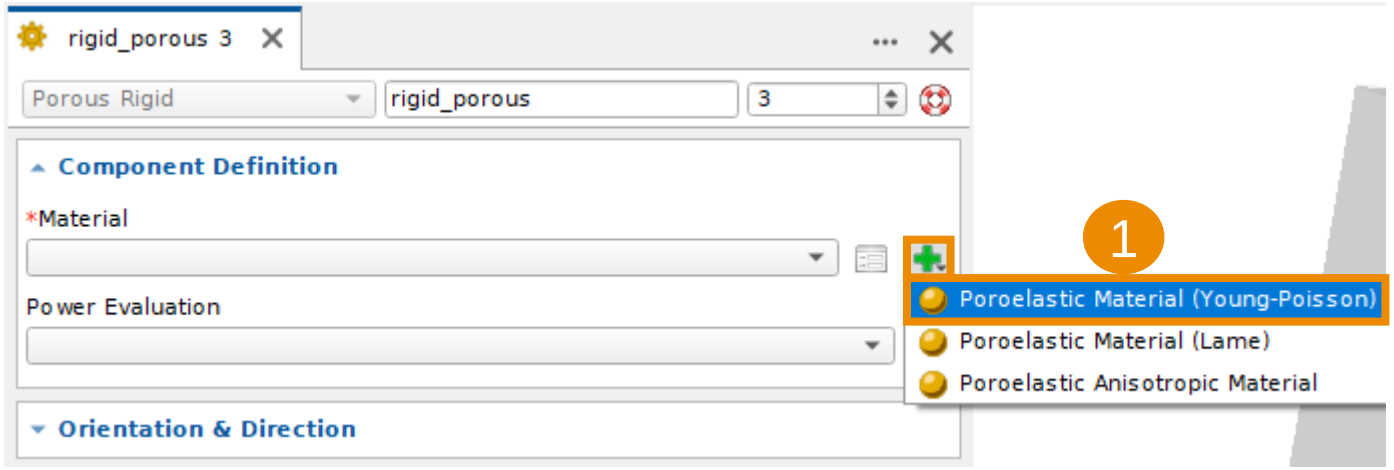


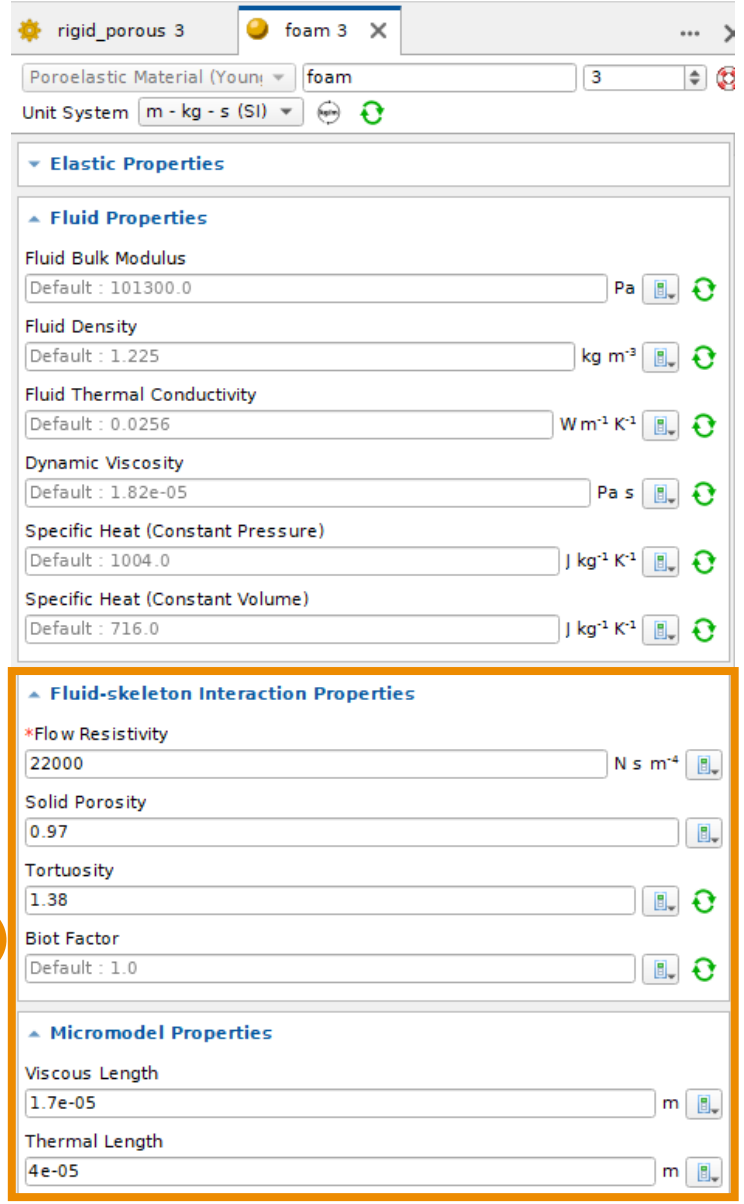
Add a Porous Rigid *component*

Set up the *foam component* domain

HEXAGON

Create a Porous Rigid component for the foam (2)





2

Define a material for foam

- Add a Fluid Material
- Set the properties

Close both property windows (material & component)

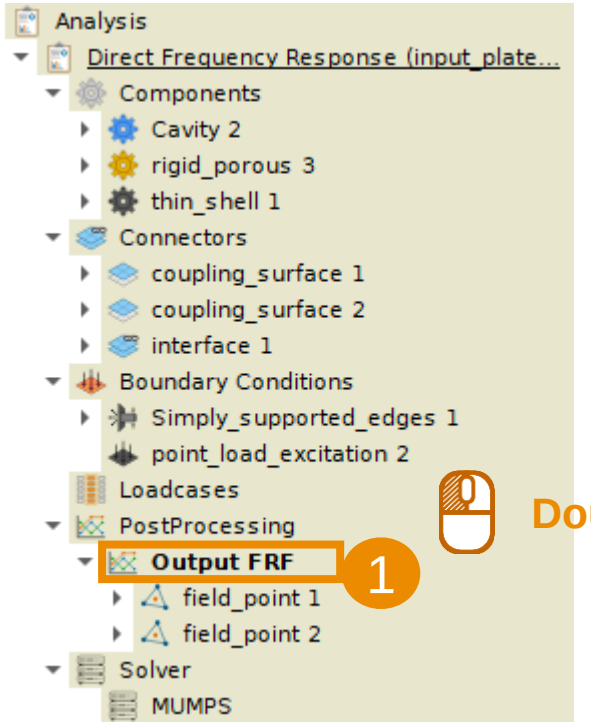
HEXAGON

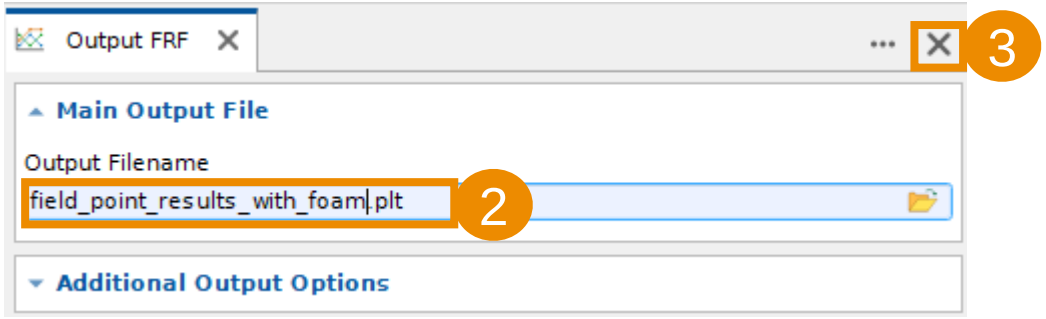
Change the output file name

Open Property window of Output FRF node

Change the name of PLT file

Close the window





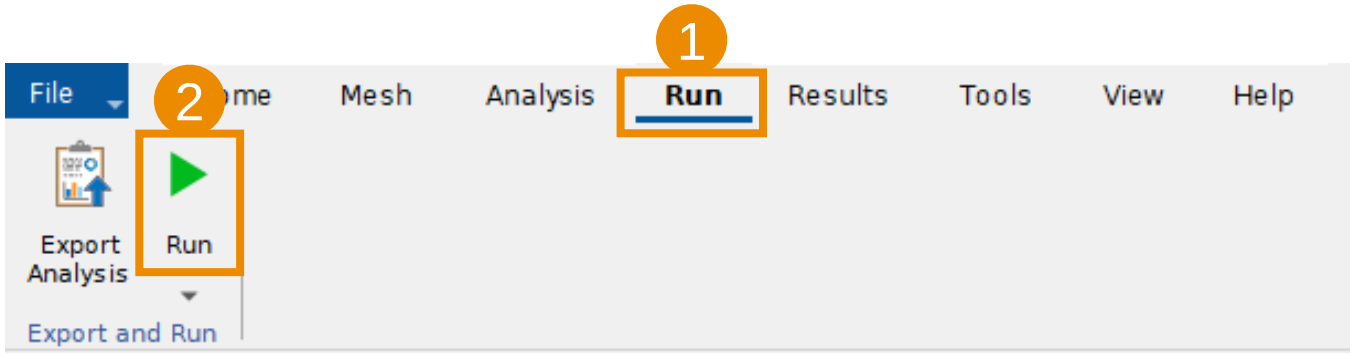
HEXAGON

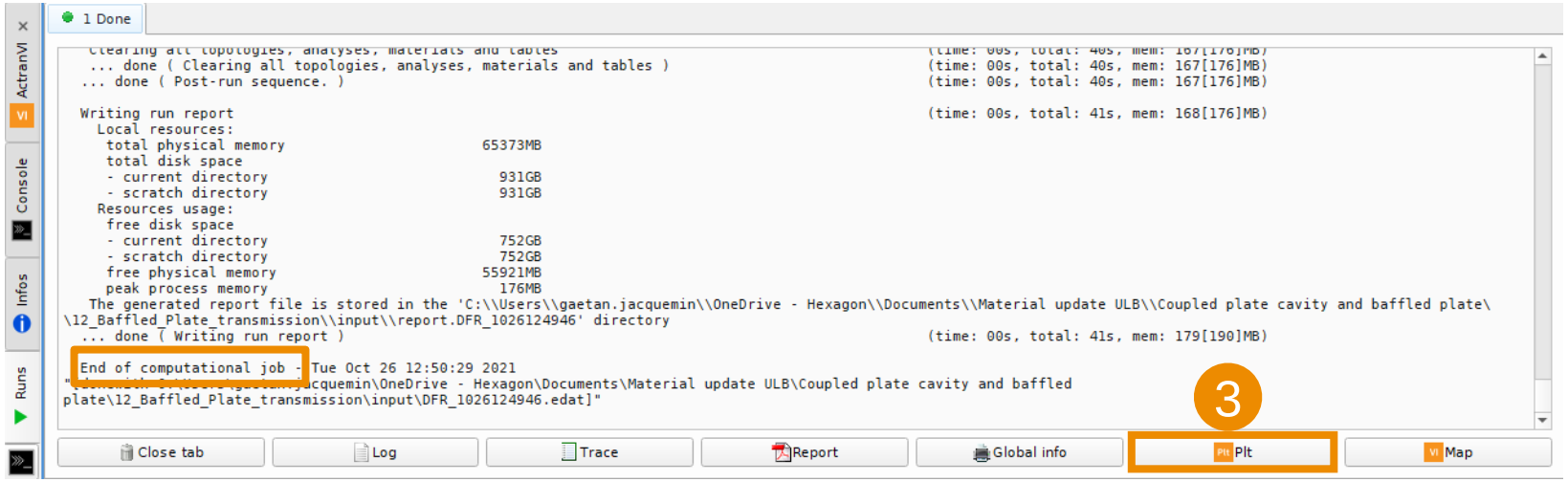
Launch the Actran analysis in ActranVI

Launch the computation

Check the log showing the computation progress

Import the *.plt computation result file





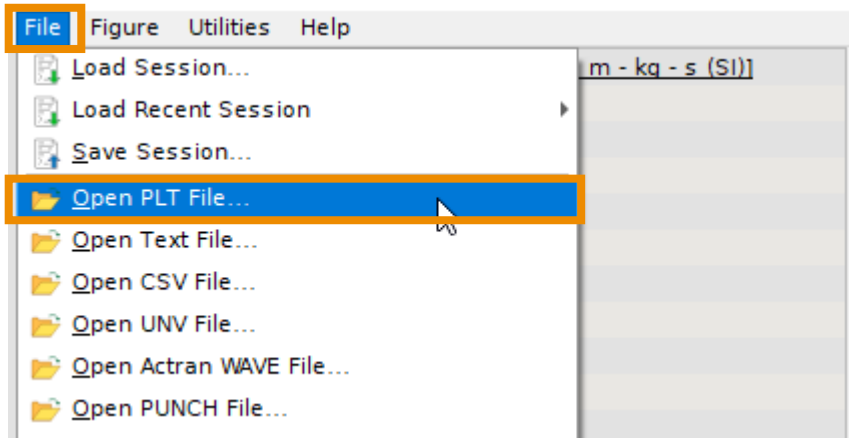
HEXAGON

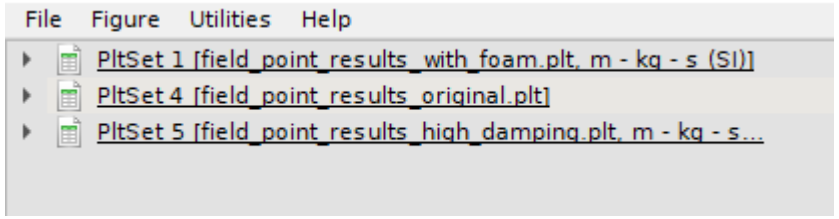
Post-processing in the PLTViewer

HEXAGON

Load the results of multiple calculations

- Load the results from:
  - Cavity with foam (already done)
  - Original simulation
    (field_point_results_original.plt provided)
  - Simulation with increased damping in plate
    (field_point_results_high_damping.plt)

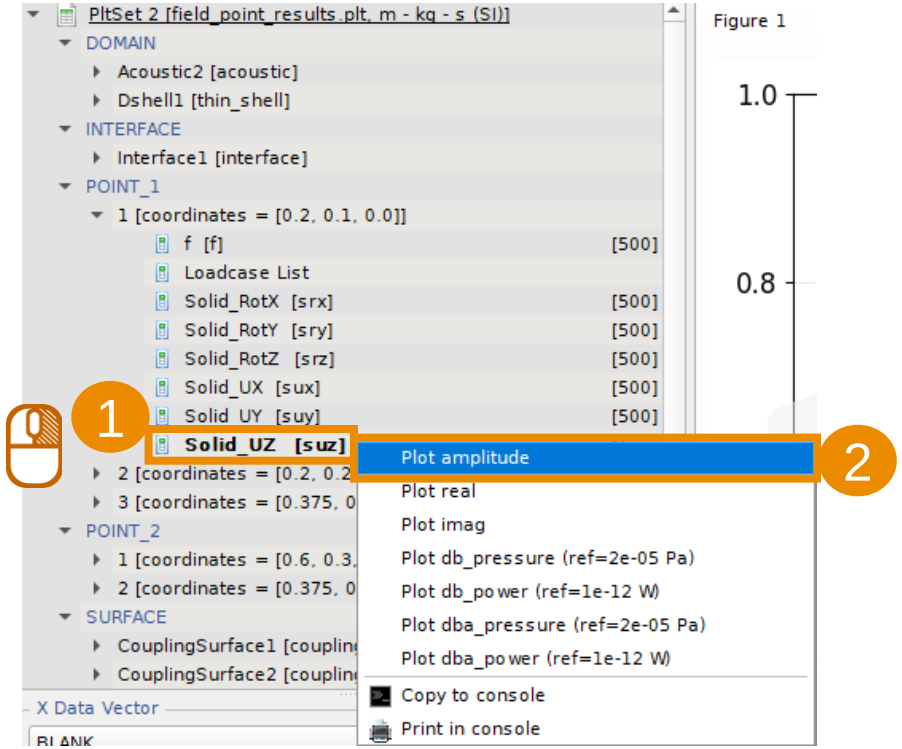


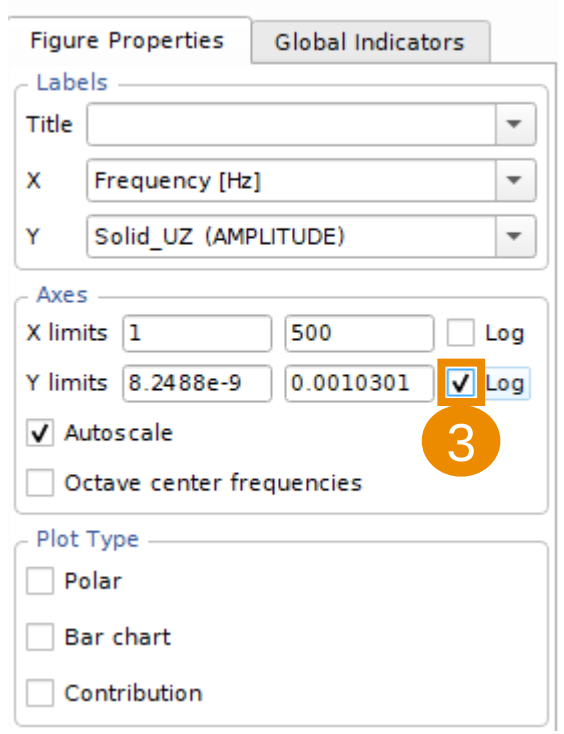


HEXAGON

Evaluate the structural displacement

- The plate vibrates along the Z axis, the amplitude of structural displacement along the Z axis is plot **for each point**
- Visualize the plot using a logarithm scale for displacement amplitude



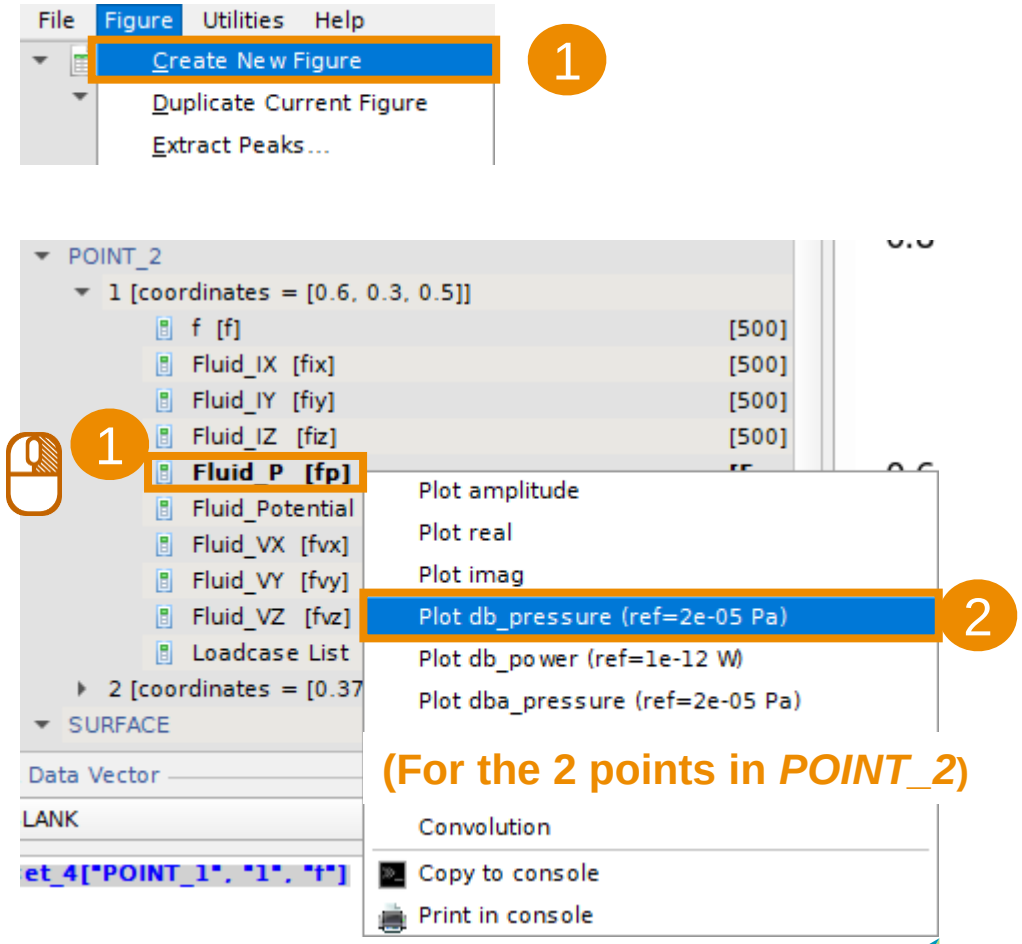


(For the 3 points in *POINT_1 group*)

HEXAGON

Evaluate the cavity acoustic pressure

- Create a new figure
- Plot the pressure of the field point 1 and field point 2 of cavity in dB (SPL)



HEXAGON

Going Further

- Combine high damping structure and foams in a single model and compare its results with the original model and two models built in this tutorial