POLITECNICO MILANO 1863	051483 Musical Acoustics Module 1: Modeling of musical instruments Academic Year 2021/2022	Homework Laboratory I Introduction to COMSOL

Assignment: Church Bell Model (3.5 points)

Generate the model of a church bell inspired by the design that you can find at the following link.

Ex. 1: Generate a 3D model of the church bell. (*2.1 points)*
(a) Build the 3D model of the church bell (*0.7 points)*
(b) Perform eigenfrequency simulation for the bell with no boundary conditions (free model), what do the first eigenfrequency represent? Export some animations related to the frequency motion. (*0.7 points)*
(c) Add a boundary load on the edge and on the side of the church bell (you are free to try also other excitation points). Then perform:
- Time Domain Study
- Frequency Domain Study

(*0.7 points)*

Ex.2: Generate an axysimmetric model of the church bell. (*1.4 points)*
(a) Model the church bell geometry using an axysimmetric model. (*0.35 points)*
(b) Compute the eigenfrequency study considering no boundaries (free model) (*0.35 points)*
(c) Repeat the eigenfrequency study, this time using the circumferential mode extension in the axial symmetry approximation in solid Mechanics (*0.35 points)*
(d) Are you able to obtain the same results of Ex1 in the case of (b) and (c)? Elaborate on that. (*0.35 points)*

HINTS:

- To draw a geometry, use sketch tools, you can find a guide at the following link
- For the boundary loads you can use a cylinder node, compute the intersection between bell and cylinder and then delete the unnecessary parts. (If boundary intersection contains undesired edges, use the Ignore Edges node and select the edges to delete).
- In order to create the 3D geometry in Ex.1 is is easier if you create it from a 2D one as done in link.
- Details about axial symmetry approximation can be found here and here.

Please provide the answers in a report as a PDF file by 3/11/2021 and upload it using the WeBeep platform in the "Assignment HL1" delivery folder. One file for each student must be uploaded. If more than one student participated to the assignment, write on the cover page of the assignment the name, surname and ID of the participating students. Also please provide the COMSOL files related to each of the exercises, since uploading of files bigger than 50 MB is not possible, please select the Clear Mesh and Clear Solutions options as detailed here.