LOUDSPEAKER HOLDER

Structure:

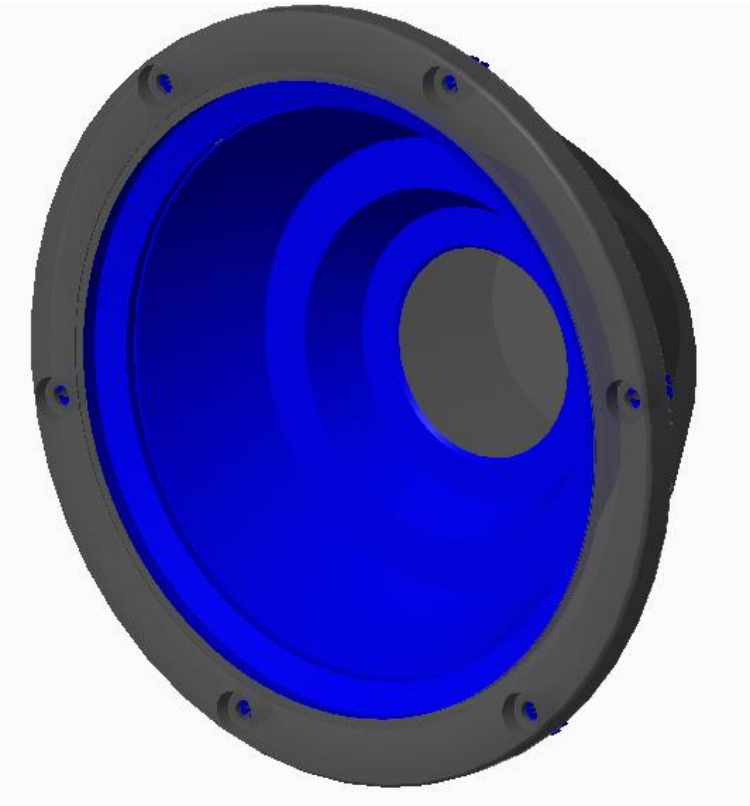
A holder carrying the electric part (magnet, ...) and the membrane of a loudspeaker

Objective:

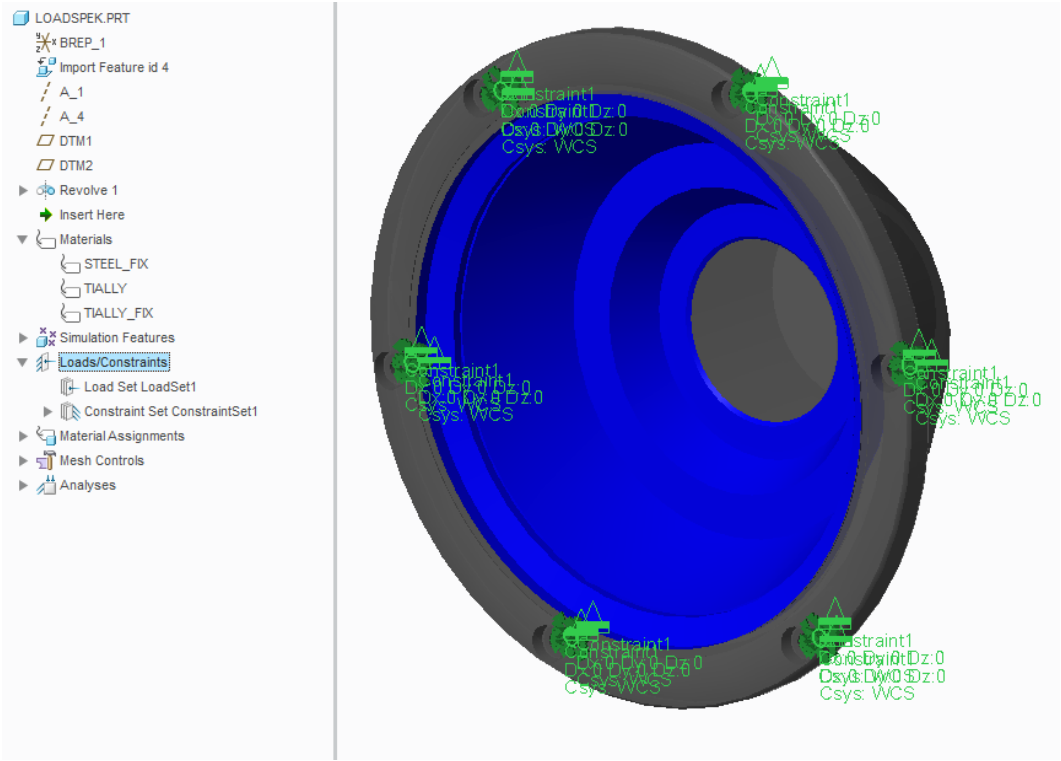
The objective is to get a holder design that will have maximal lowest eigenfrequency at some prescribed volume of the material. Topology optimization will be used to address the problem.

CAD and FEA model

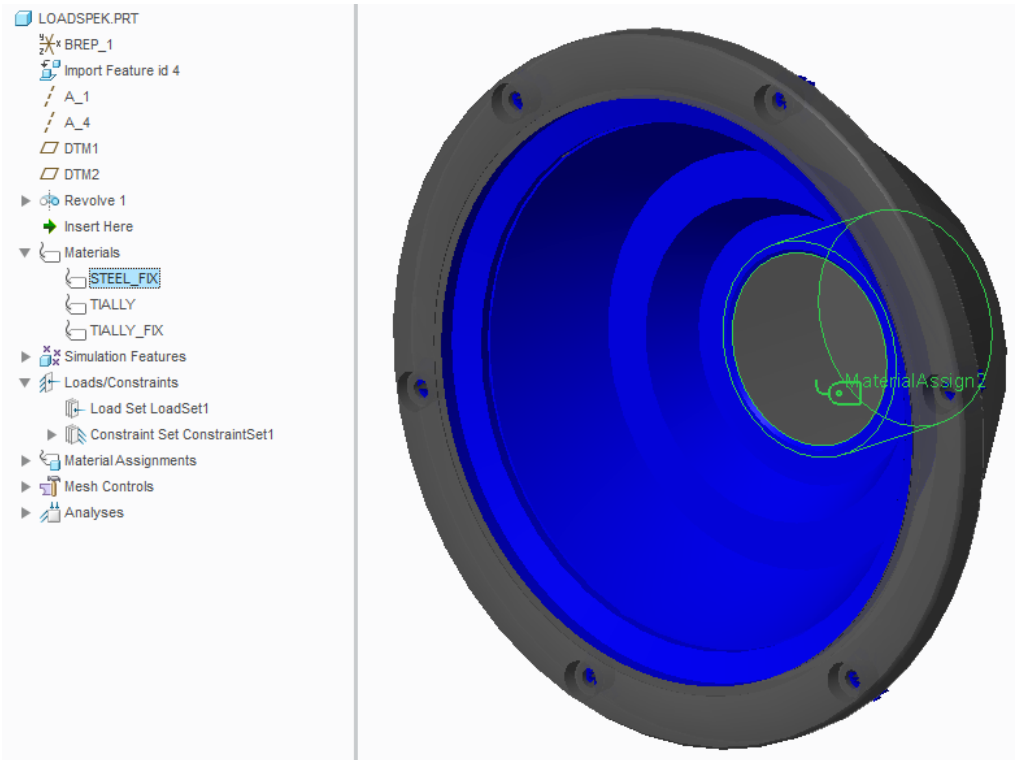
Initial CAD geometry was made by CAESS with PTC® Creo. The loudspeaker holder material domain consists of two regions: a fixed one (gray) and a free one (blue). Within the free region material can be removed/redistributed as necessary



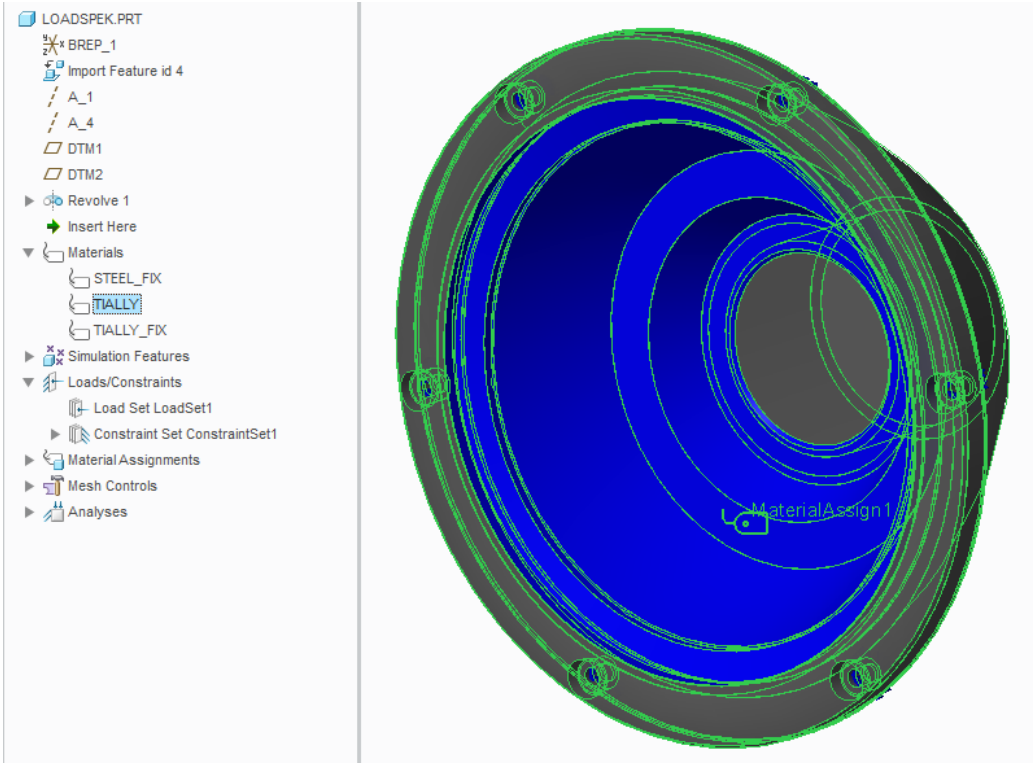
Boundary conditions.



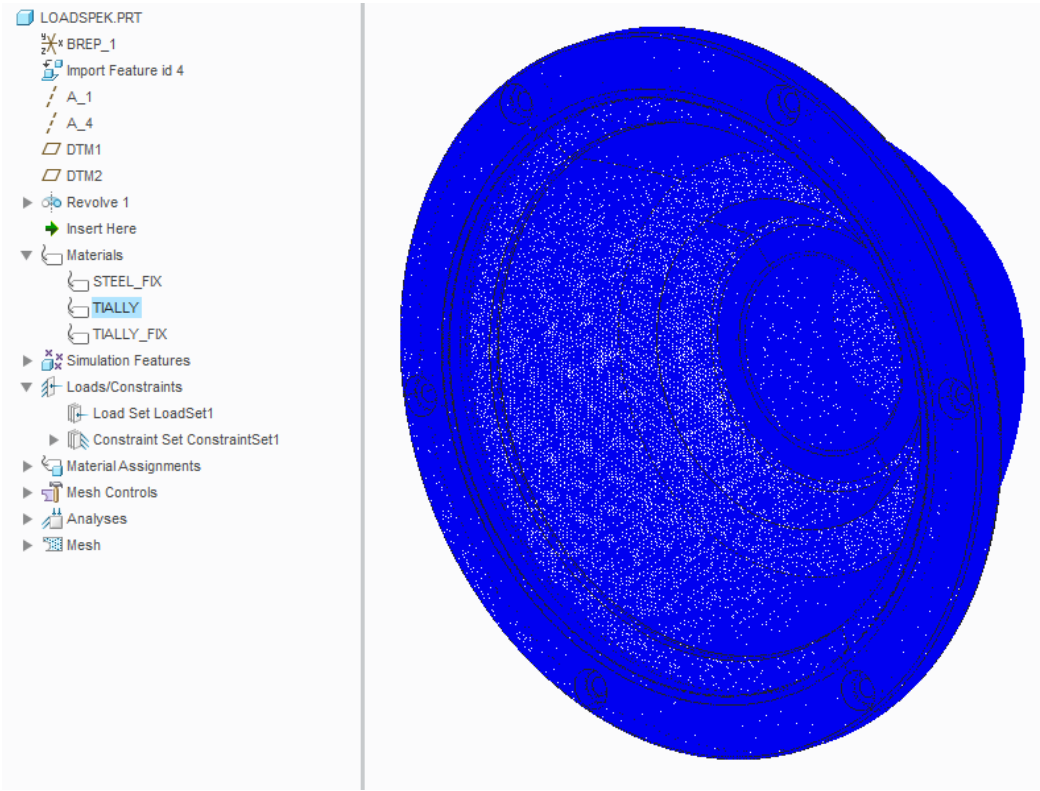
Material assignment: Steel.



Material assignment: Tially.



FEA model in PTC® Creo.



Optimization by CAESS ProTOp

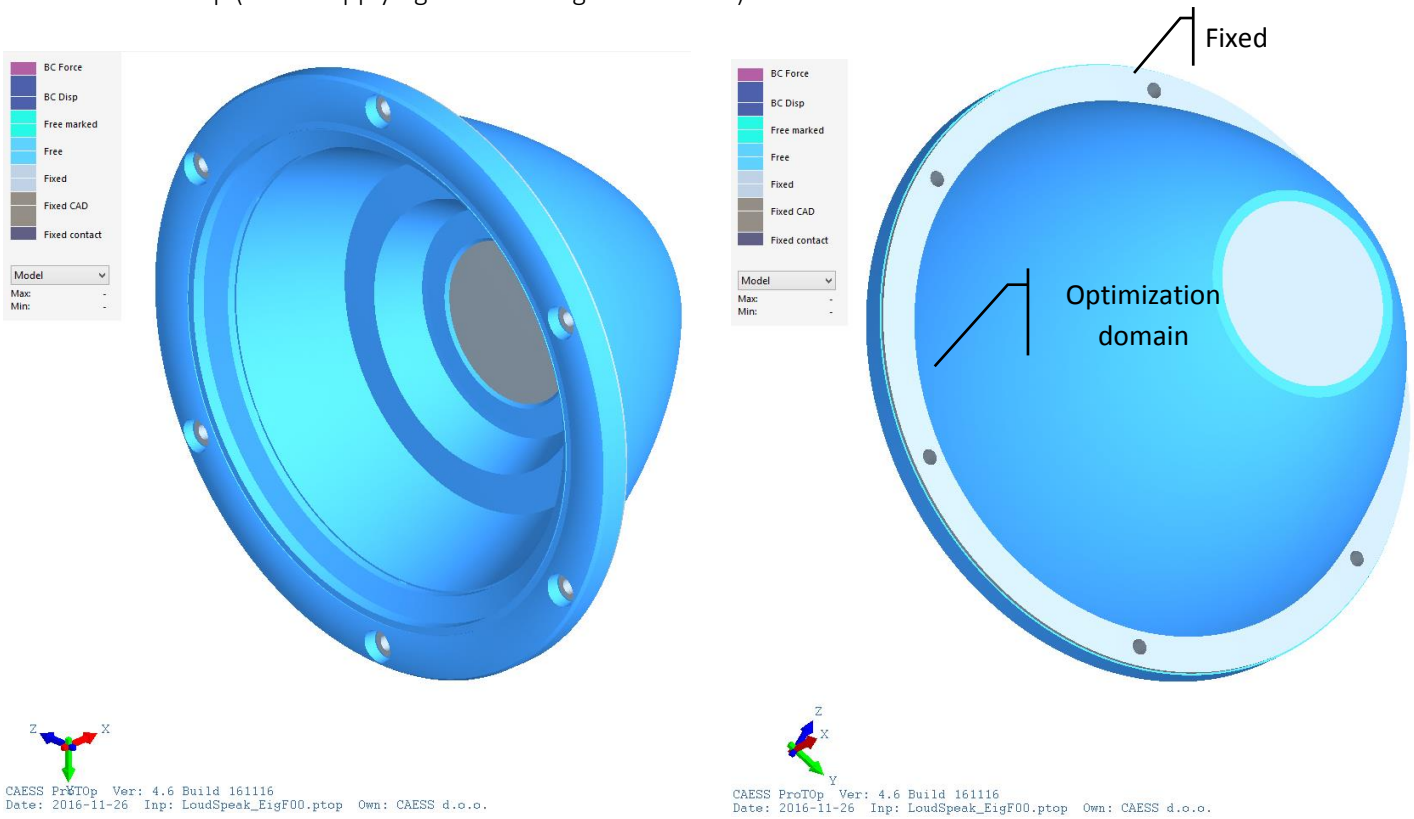
Topology optimization was engaged to find a prescribed-volume-design, exhibiting the lowest eigenfrequency. To speed-up the optimization process, optimization was not started from solid configuration. Instead, to reduce the CPU time and RAM requirements, the so called bottom-up optimization was run. For this purpose, the starting design was a configured within ProTOp to be lattice structure. The configuration parameters of the lattice were defined in such a way that material was allowed to appear or disappear in the whole optimization domain (i.e. the initial lattice structure was able to vanish completely).

Finite elements used: special topology-optimization-enriched linear tetrahedrons.
Configuration: lattice structure (capable of vanishing completely).

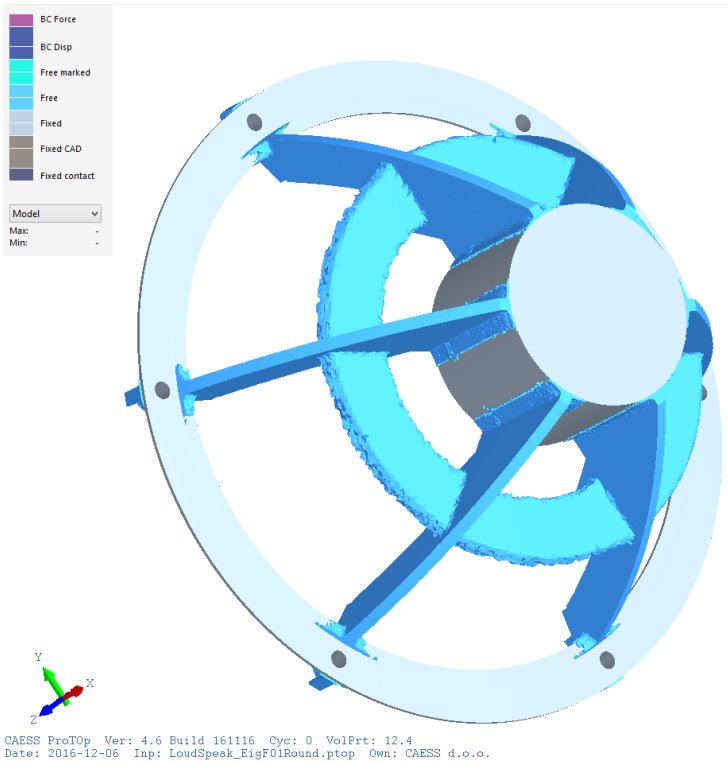
Numerical data of the model			
Elements: 2.6 million	DOF: 1.4 million	Max RAM: 7 GB	

Initial model

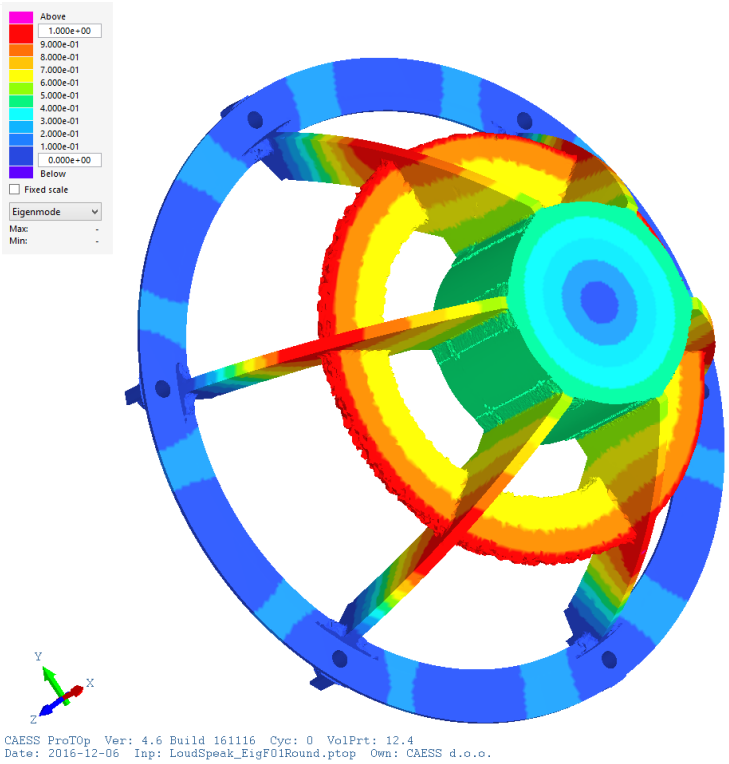
Solid model in ProTOp (before applying lattice configuration tools).



Lattice model made from solid model with ProTOp.

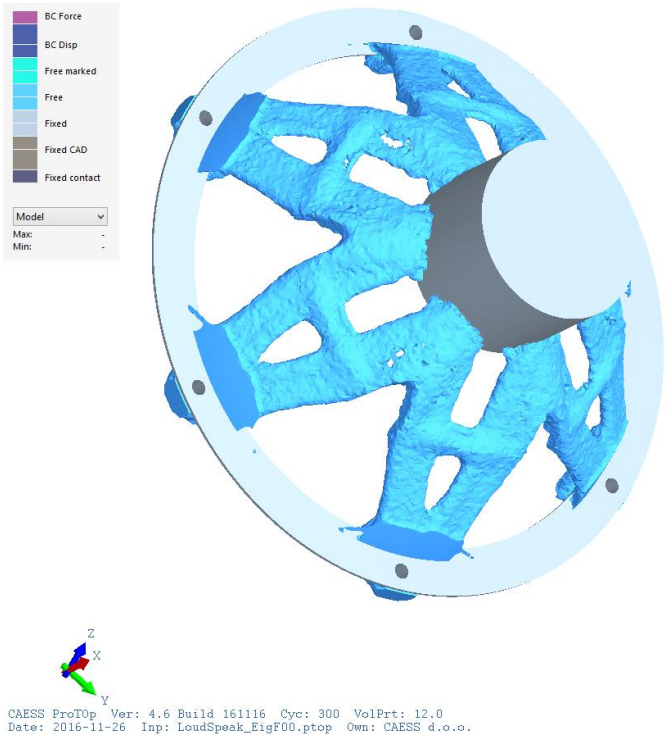


Lattice model - eigenfrequency mode.

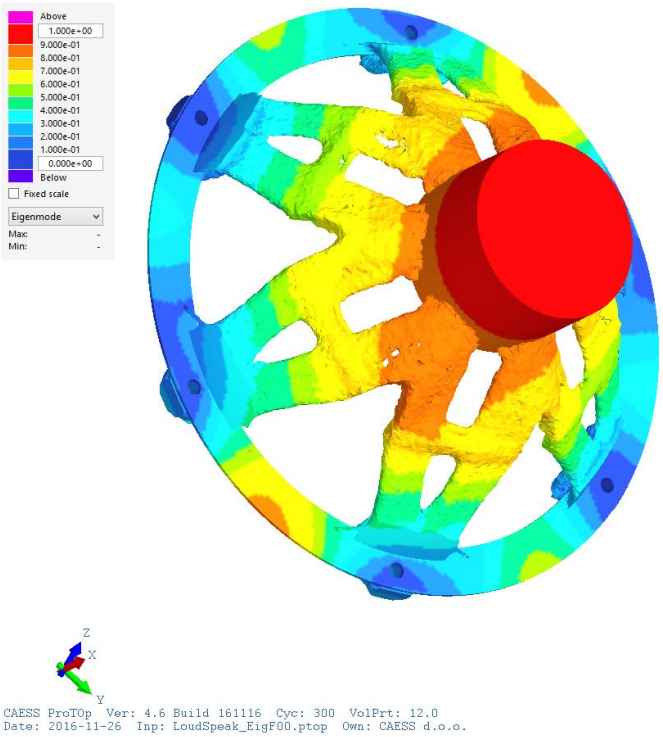


Optimal model

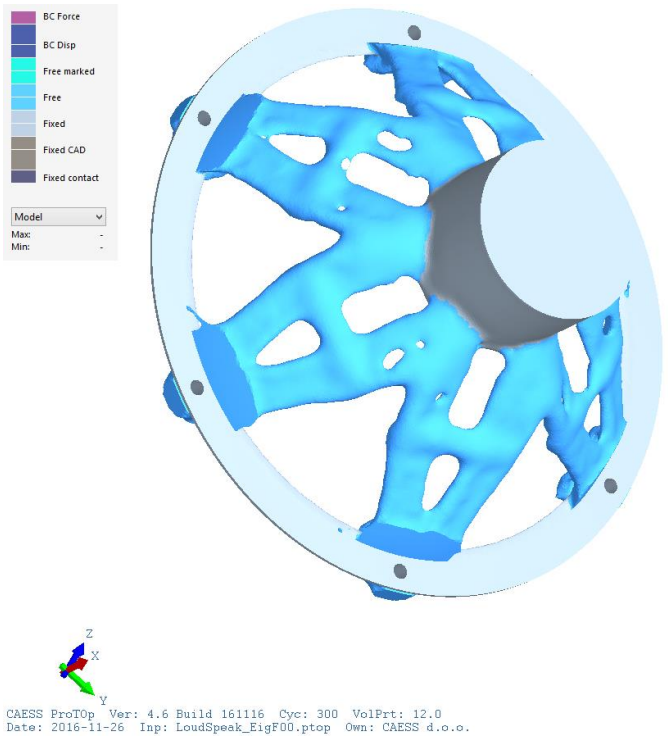
Optimized model in ProTOp.



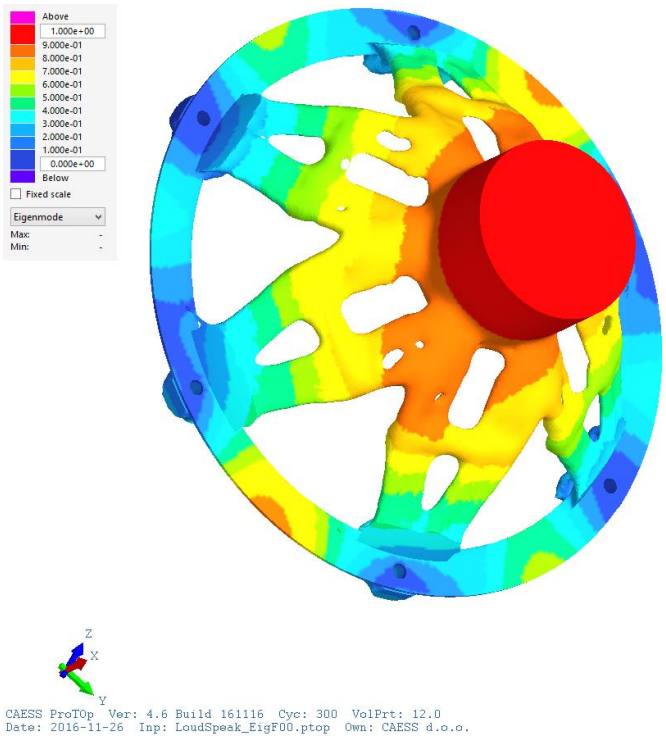
Optimized model - eigenfrequency mode.



Optimized and smoothed model in ProTOp.



Optimized and smoothed model - eigenfrequency mode.



Results

Numerical data		
Free domain volume: 4,167e+05 mm^3		
Required volume: 0,500e+05 mm^3		
	Initial model	**Optimal model**
Volume, mm^3	0,502e+05	0,496e+05
Lowest eigenfrequency, Hz	788.5 Hz	2440. Hz