Perfect line simulation

1. Description

This example illustrates a perfect transmission line (coaxial structure) with great performance from DC up to 60 GHz.. The structure is made up of PEC material along with Ultem 1000 material. The structure inherits the shape of a coaxial transmission line with few differences: it is made up of PEC material and Ultem 1000 material. further description of its composition and performances is found in the next sections.

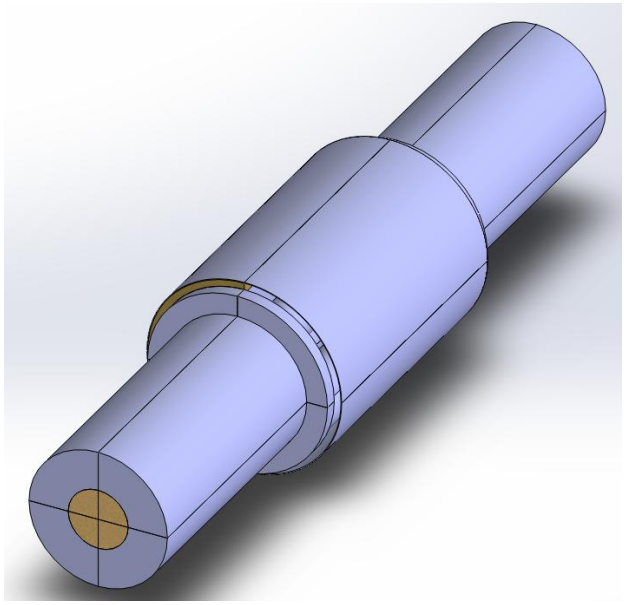
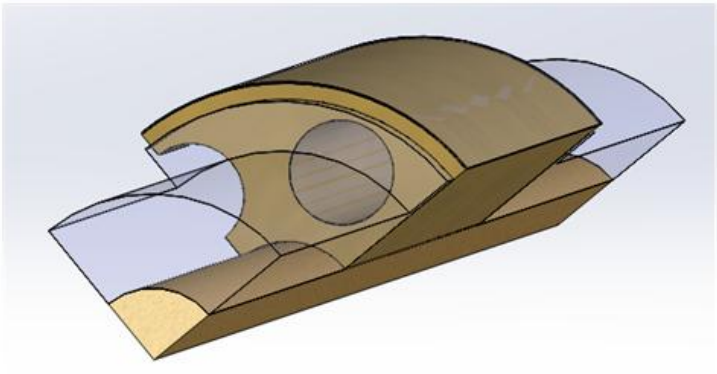


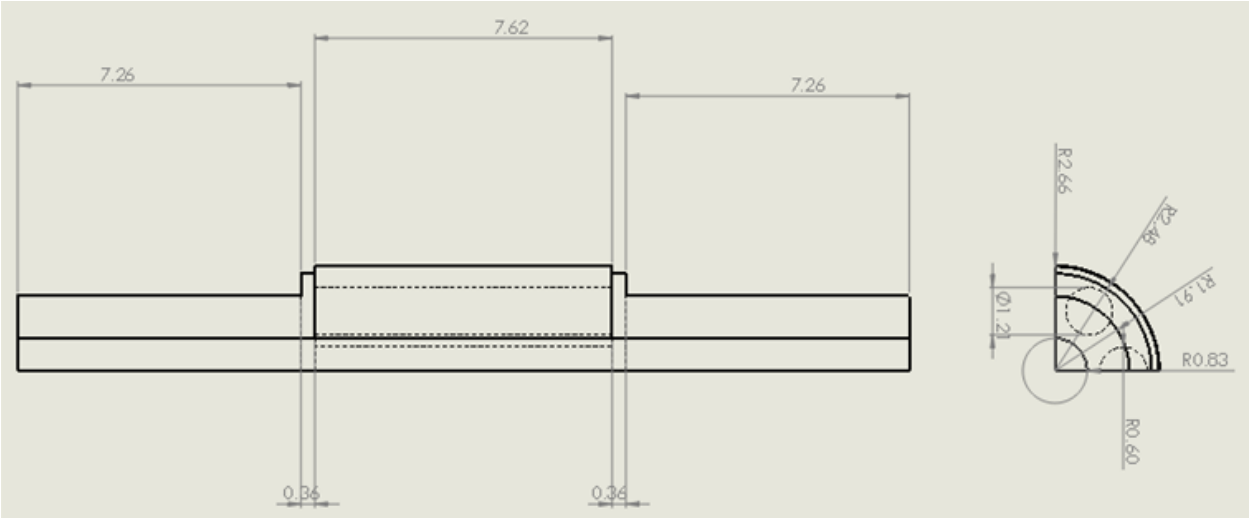
Figure 1: Perfect line 3D structure



The Ultem material is assigned to the shape in brown. the shape has a particular format with a pattern of holes. Further description of the shape is available in the next figure.

Dimensions

The simulation can run faster if we profit from the symmetry of the model. Indeed, HFWorks needs only quarter of the model to be designed : It is always useful to use symmetry whenever the model allows to do so. The following figure shows the dimensions of the line quarter's structure. All dimensions have been annotated and given in millimeter.



The units are given in millimeter.

2. Simulation

The design and dimensions of the model have been optimized to a point where good performance was observed. The simulation is using the Scattering Parameter solver from DC to millimeter wave frequencies with Fast sweep or Discrete sweep. The created Finite Element mesh must respond to a certain extent of accuracy on the eddy areas of curved bodies.

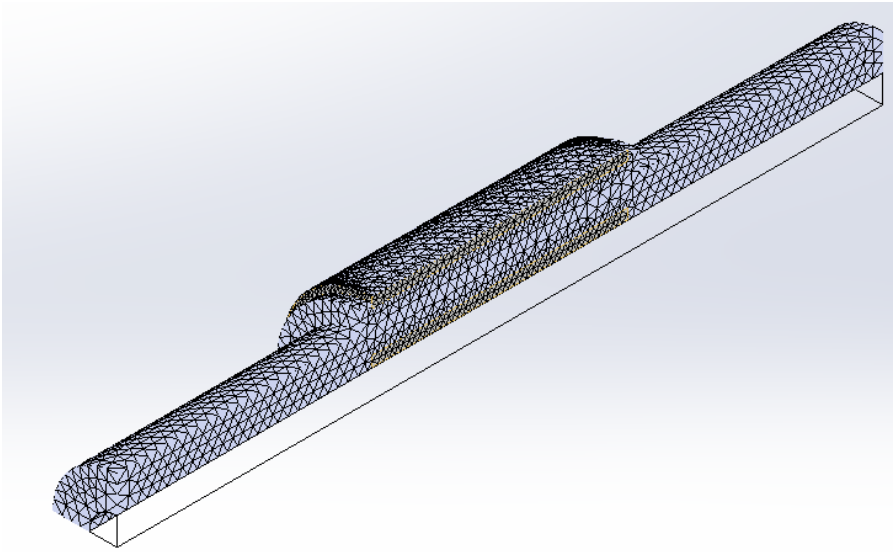


Figure 2: Mesh of the structure

3. Load/ Restraint

The propagation of waves is considered in TEM mode: We assign signal boundary condition to the outer surface of the RF signal carrier i.e. the lateral face of the extruded cylindrical cut . The lateral revolution (cylindrical) shapes of the structure are treated as perfect electric conductors.

4. Results

The output results show that we have excellent performance over a wide range of frequency from DC up to 60 GHz : approximately zero insertion loss and a return loss better than 20 dB.

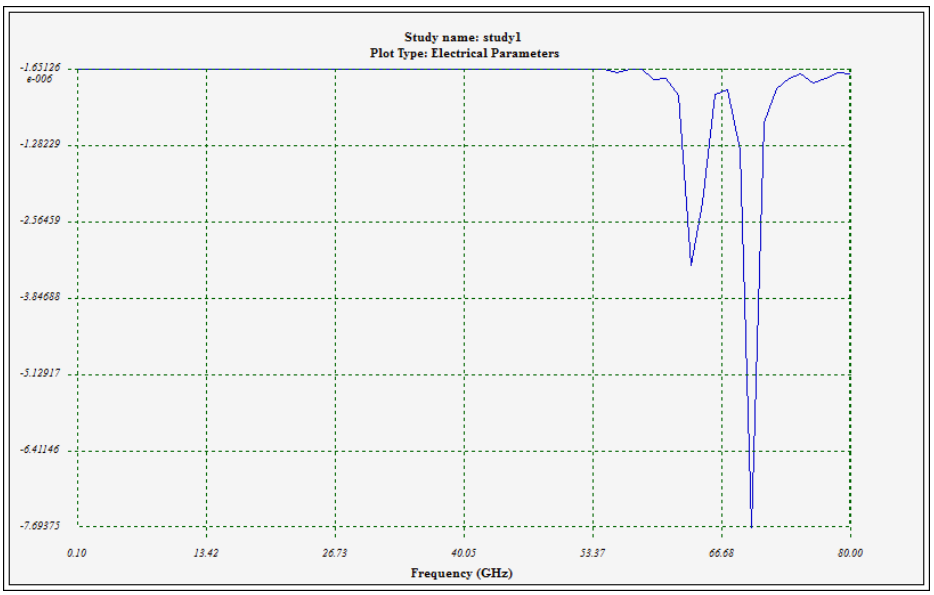


Figure 3: Insertion loss

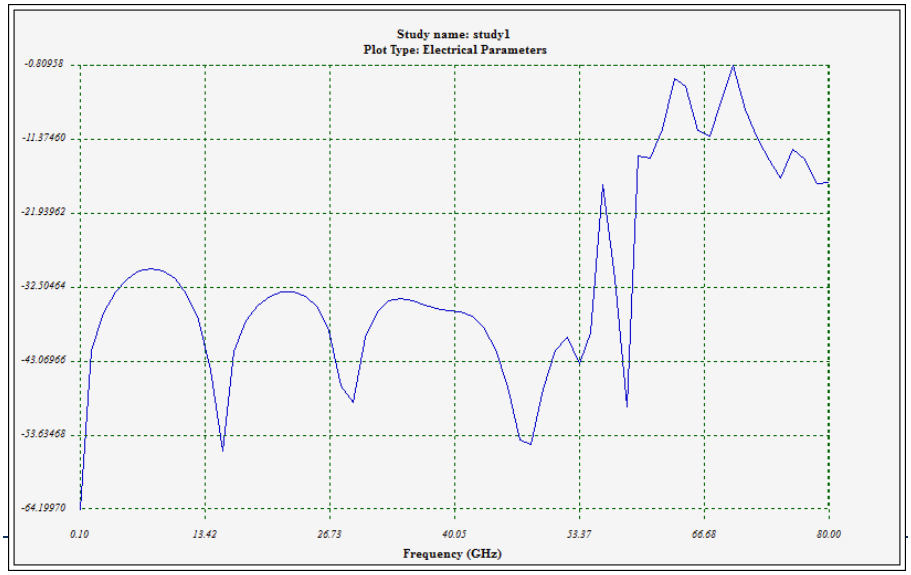


Figure 4: Return loss

Using the 3D viewer of HFWorks, we can have a closer view on the inner field distribution of the structure.

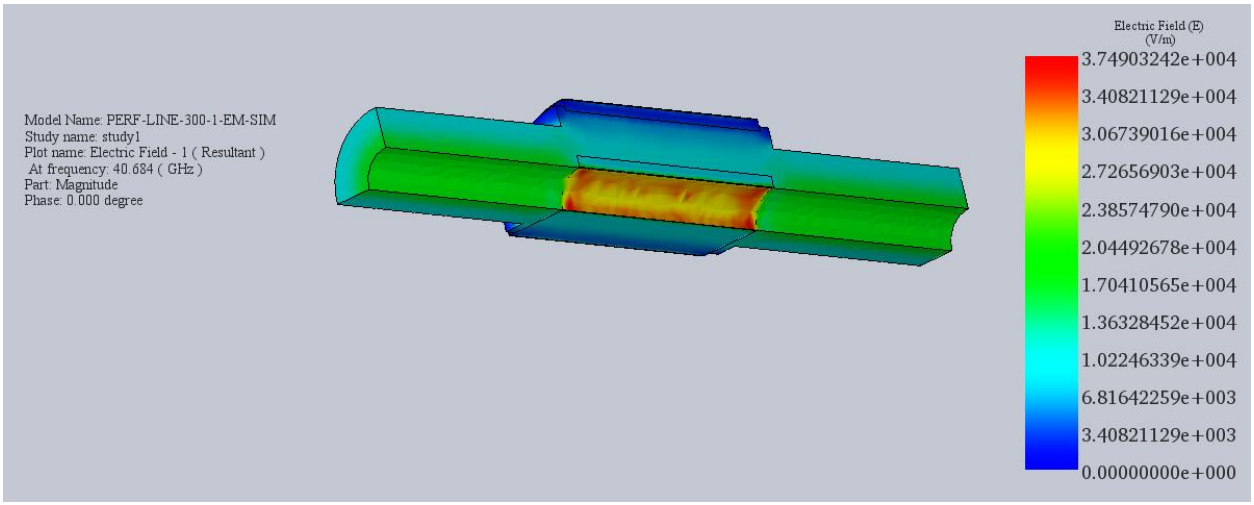


Figure 5: Inner distribution of electric field at 40 GHz