EIGENMODE SOLVER IN CST

Representation of the stopband behavior (dispersion diagram) of a gap waveguide structure

Aitor Morales-Hernández

Group of Microwave and Applied Computational Electromagnetics (GMECA)
University Institute of Physics Applied to Sciences and Technologies
University of Alicante

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Chapter 1. Objective

The main objective of this document is to describe the main steps to represent the dispersion diagram of a gap waveguide structure using the Eigenmode Solver of the CST® software tool. In this way, the stopband behavior of the structure can be simulated for specific dimensions of the bed of nails of a gap waveguide structure.

Chapter 2. Steps

First, on the *Modelling* tab, the top and bottom metal plates of one nail of a generic gap waveguide structure must be designed, as shown in Fig. 1. Please, note that it is also important to add the air volume of the structure.

The pin designed for the simulation of the dispersion diagram here described is shown in Fig. 1, where the main dimensions are $W_p = 1.9$ mm, $L_p = 1.9$ mm, $h_p = 4.5$ mm, $h_a = 1$ mm, $p_x = 3.6$ mm and $p_z = 3.6$ mm.
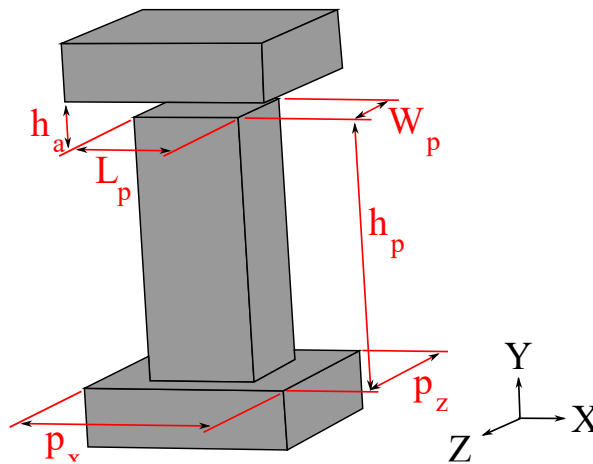
Figure 1 – *Generic pin and its main dimensions.*

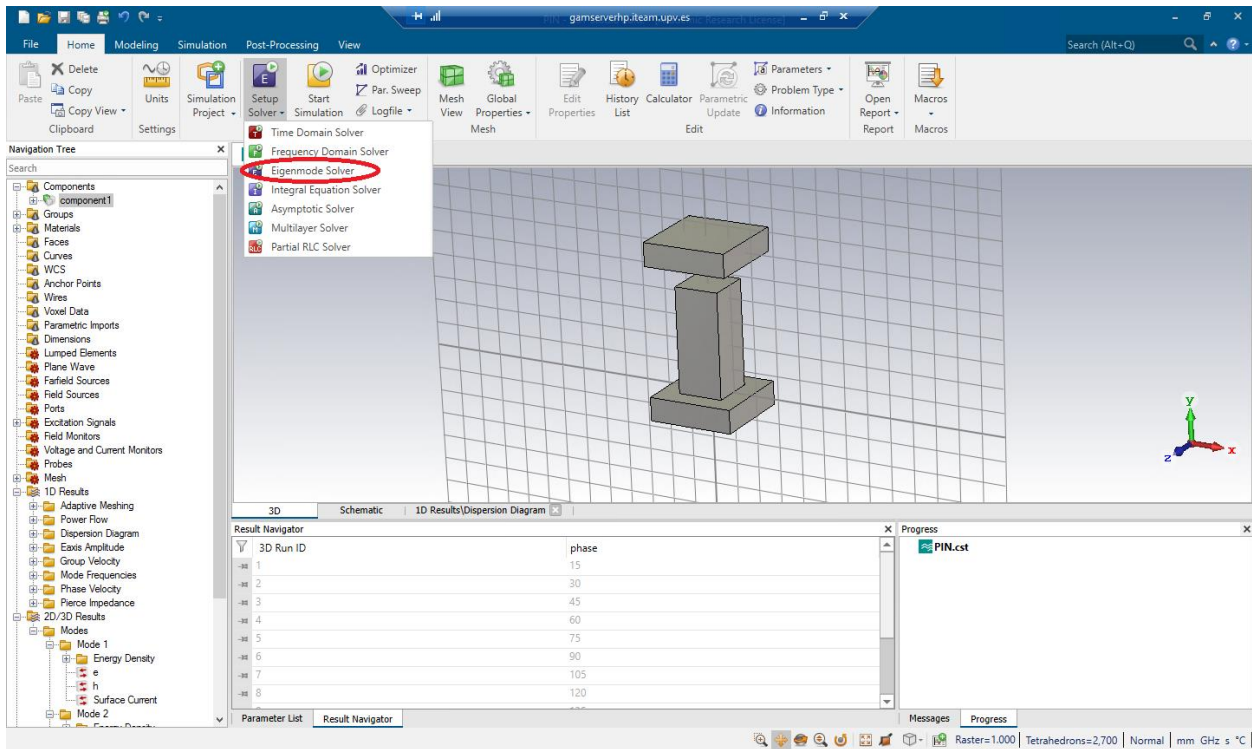Next, on the *Home* tab, choose the *Eigenmode Solver*, as shown in Fig. 2.

Figure 2 – *Chose the Eigenmode Solver on the Home tab.*

On the *Simulation* tab, it is necessary to specify the boundary conditions of the designed pin. Click on *Boundaries*. Choose *periodic* for the X and Z axes and *electric* for the Y axis, as shown in Fig. 3.
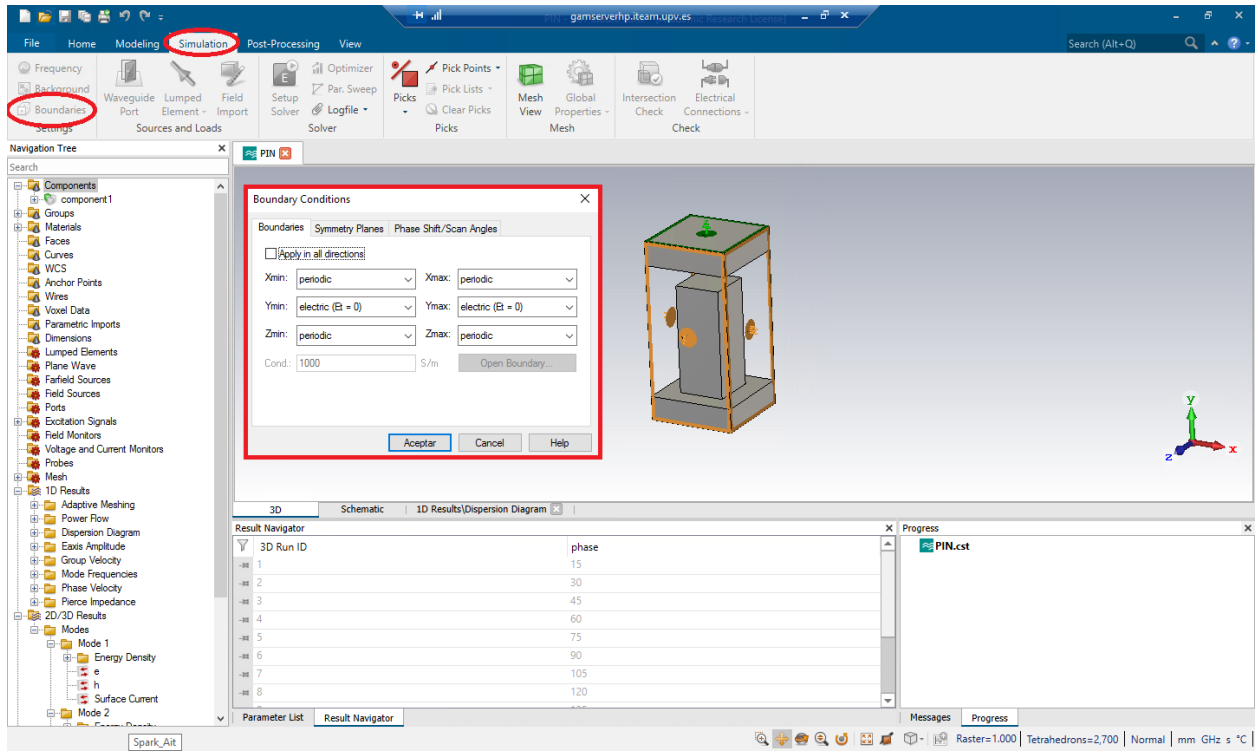

Figure 3 – *Boundary conditions*

On the *Phase Shift/Scan Angle* tab, define the new parameter **phase** for the X axis, as shown in Fig. 4, and set an initial value of 180 degrees, for instance.
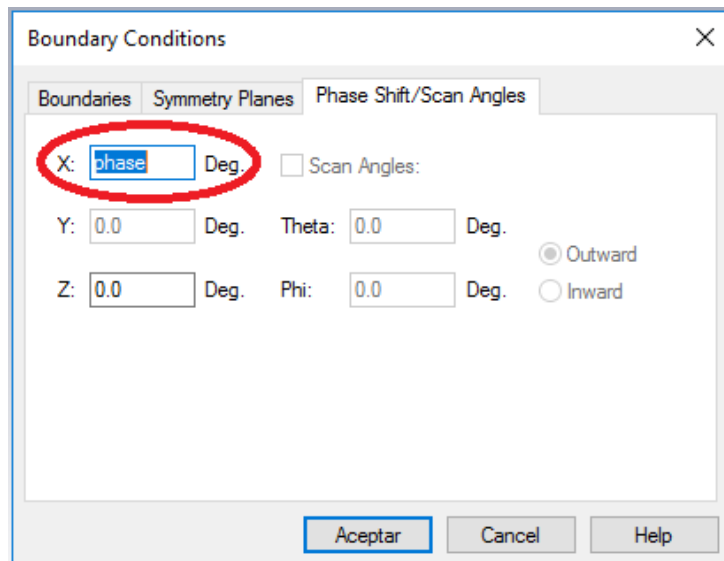

Figure 4 – *Creation of the new parameter "phase".*

Next, go to *Home → Macros → Solver → E-Solver → Define Slow Wave userdefined Watch* and enable that option as shown in Fig. 4.
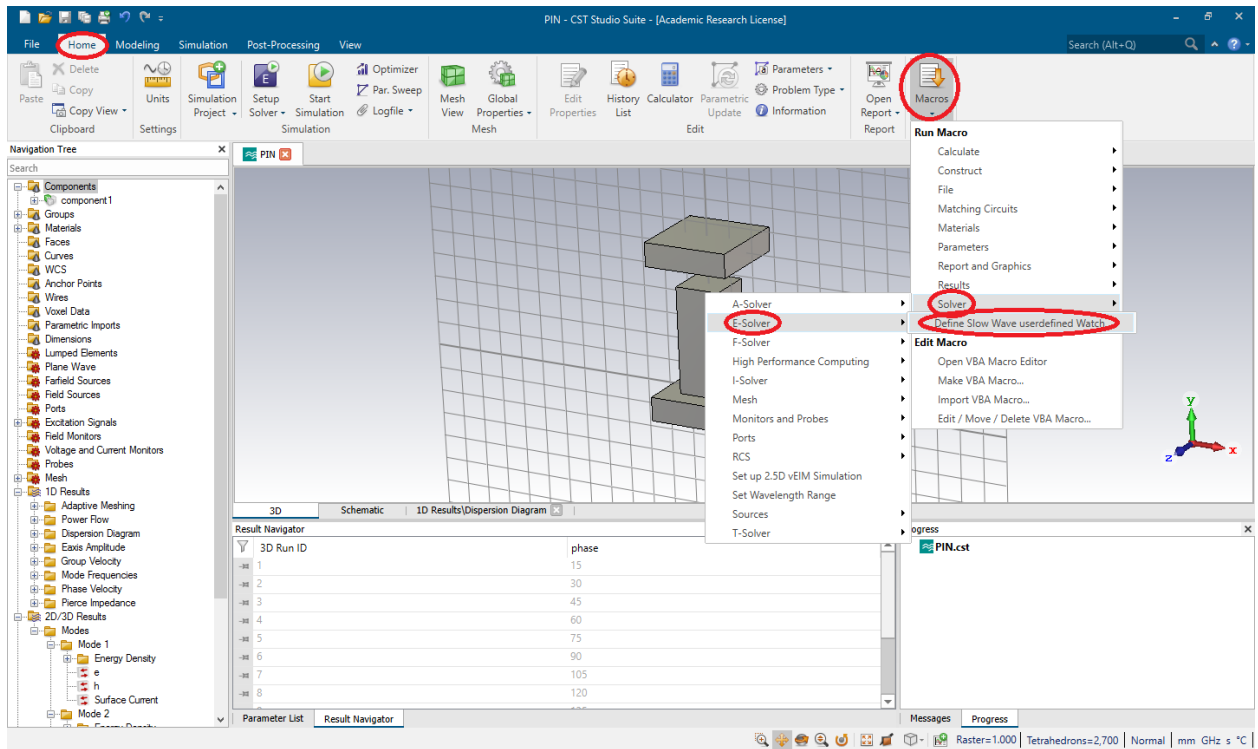

Figure 5 – *Enable the "Define Slow Wave userdefined Watch" option.*

On the *Home* tab, click on *Par. Sweep* to configure the sweep of the parameter **phase**. Next, click on *New Seq.* and set the parameters as shown in Fig. 6. Please, note that it is also possible to configure other different width of the step or the number of samples.
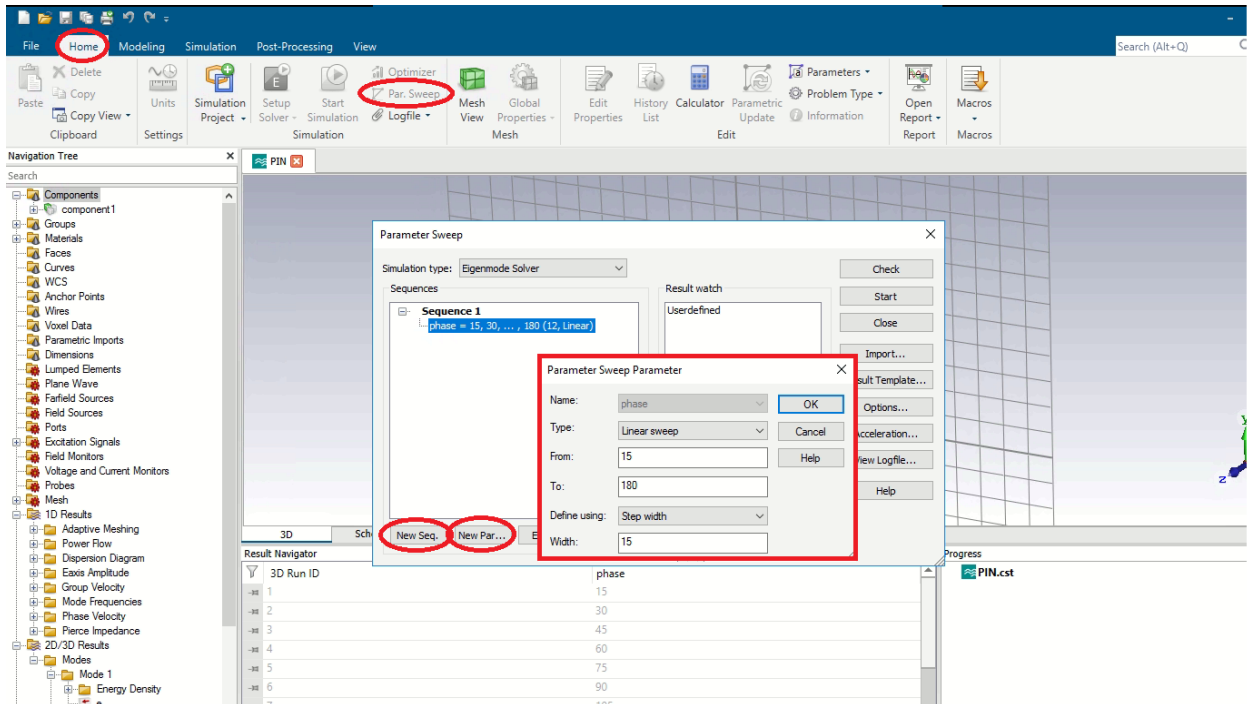

Figure 6 – *Configuration of parameter sweep.*

Finally, on the *Home* tab, click on the *Eigenmode Solver* and define the required number of modes, as shown in Fig. 7. Next, click on *Par. Sweep* and press the *Start* button to launch the simulation process.
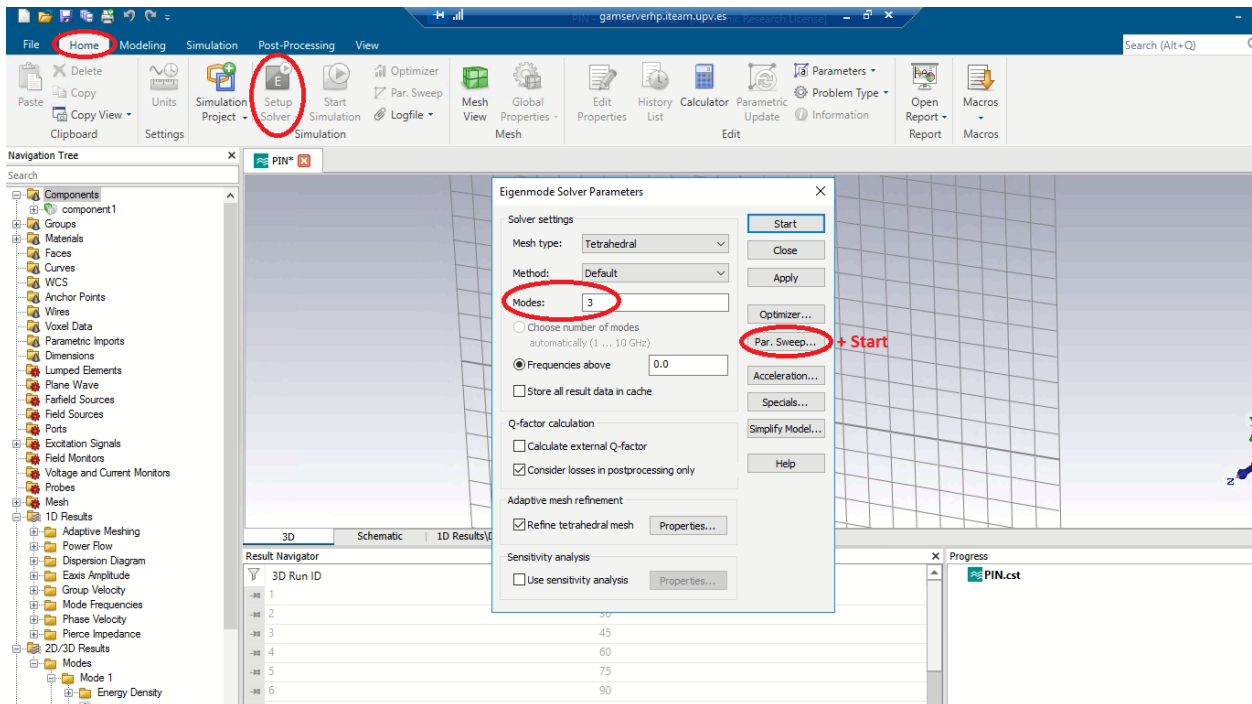

Figure 7 – *Configuration of the number of modes.*

For the representation of the dispersion diagram, open the *Dispersion Diagram* plot, which is included in the *1D Results* folder.
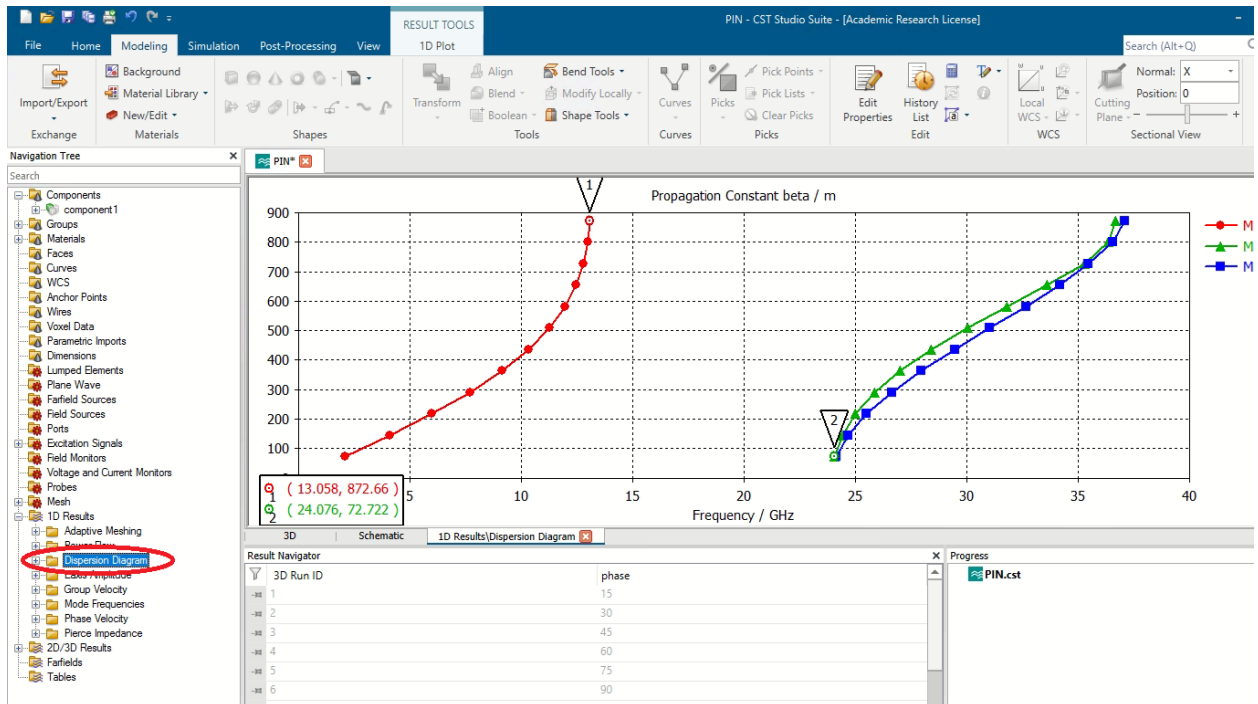

Figure 8 – *Representation of the Dispersion Diagram.*