TEST CASE 5: Radar Cross Section of a Resonant Antenna

Monostatic and Bistatic RCS Simulations

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1. *Definition of the Geometry*

The case is a resonant antenna composed by an array of slotted rectangular waveguides fed by a waveguide perpendicular to the waveguide array. The feeding of each waveguide of the array is made by a slot of the feeding waveguide. Figure 1.a and 1.b show the geometry. The antenna can be assumed to be perfect conducting. When the structure works as antenna the structure is fed by the port defined in the left side of the feeding waveguide. The structure can be enclosed in a parallelepiped of dimensions: 38 cm in x-axis, 36 cm in y-axis and 1.8 cm in z-axis.

An IGES file of the geometry can be asked by email: webmaster@fasant.com.

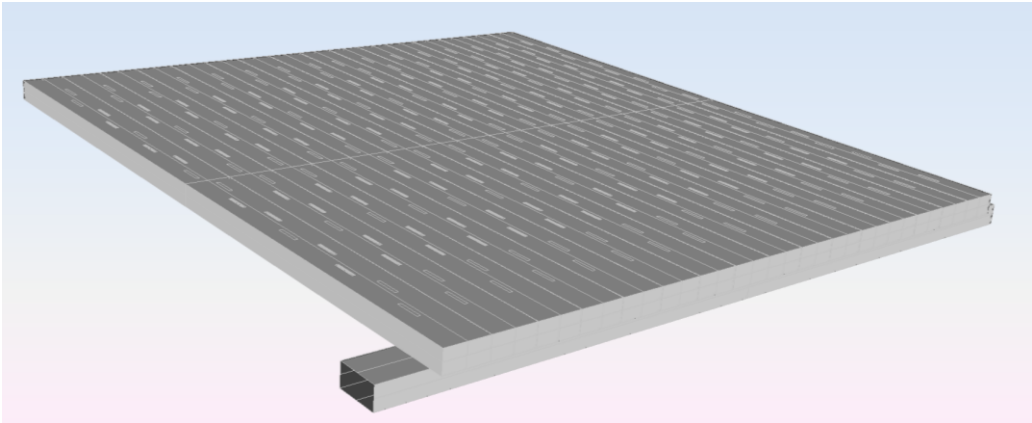

Figure 1.a. View of the resonant antenna.

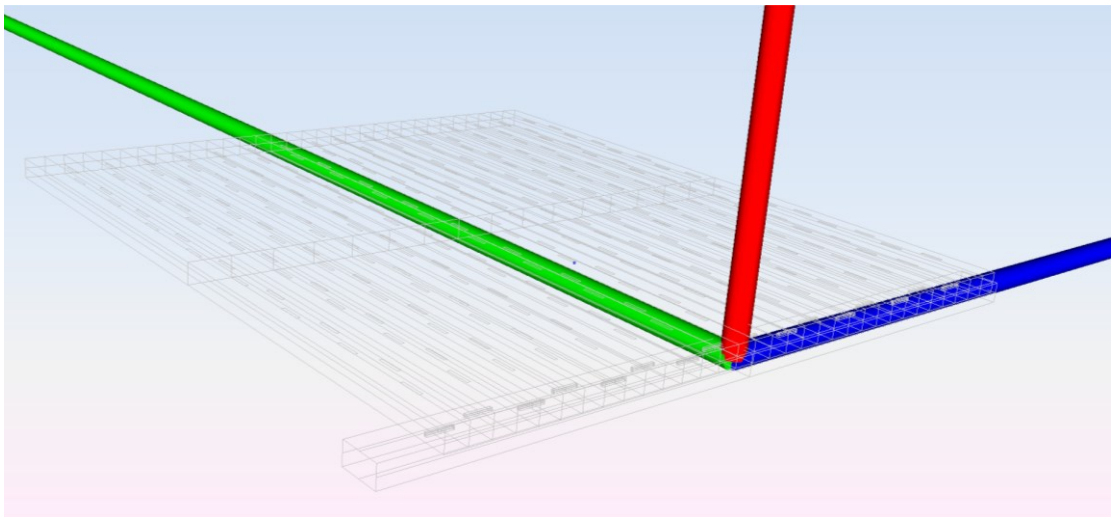

Figure 1.b. Geometry of the resonant structure. The x, y, z axes are indicated by the blue, green and red lines, respectively.

2. *Simulation Parameters*

The time dependency is assumed to be exp(jωt).

The following results shall be provided for a working frequency of 10.5 GHz:

2.1. Case (a): Bistatic RCS

Bistatic Radar Cross Section obtained in the *zy*-plane when a plane wave is incident in $\theta = 0.0°$, $\phi = 270.0°$ direction and ϕ -polarized. The results shall be obtained at $\phi = 270.0°$ from $\theta = -90°$ to $\theta = +90°$ for a 0.5 degree step.

2.2. Case (b): Monostatic RCS phi-pol. incident plane wave

Monostatic Radar Cross Section obtained in the *zx*- and *zy*-planes for a phi-polarized incident plane wave. The results shall be obtained from $\theta = -10°$ to $\theta = +10°$ for a 0.5 degree step.

2.3. Case (c): Monostatic RCS theta-pol. incident plane wave

Monostatic Radar Cross Section obtained in the *zx*- and *zy*-planes for a theta-polarized incident plane wave. The results shall be obtained from $\theta = -10°$ to $\theta = +10°$ for a 0.5 degree step.

3. *Data Formats*

The results will be stored in ASCII files, labelled as:

- *test_case_5a_CONTRIBUTOR_NAME.txt*
- *test_case_5b_CONTRIBUTOR_NAME.txt*
- *test_case_5c_CONTRIBUTOR_NAME.txt*

where "CONTRIBUTOR_NAME" should be replaced by the name of the contributing institution, if necessary followed by a postfix indicating the method used for the simulations, e.g., Contributor1_FDTD, Contributor1_MoM,…

Each file will contain on each row the data :

$$\theta \quad \mathrm{Re}(E_{\theta\theta}) \quad \mathrm{Im}(E_{\theta\theta}) \quad \mathrm{Re}(E_{\phi\phi}) \quad \mathrm{Im}(E_{\phi\phi})$$

where θ is the angle in degrees, $E_{\theta\theta}$ and $E_{\phi\phi}$ are the complex co-polar scattered fields in V/m in $\theta\theta$-polarisation and $\phi\phi$-polarisation. $E_{\theta\theta}$ and $E_{\phi\phi}$ shall be normalized according to $\sigma_{\theta\theta/\phi\phi} = 20*\log10(4\pi\ \mathrm{abs}(E_{\theta\theta/\phi\phi}))$, where σ is the RCS in dBsm.

4. *Additional Information*

Each *.txt*-file should be accompanied by a *.info*-file, stating additional information relevant for the simulation, e.g., short description of the method used, CPU time, memory usage, number of unknowns, characteristics of simulation hardware (number of cores, processor speed),…