

TEST CASE 7 : Dielectric Cube

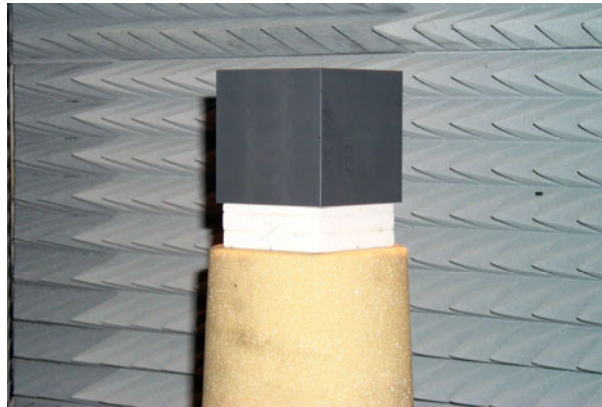
Monostatic RCS for a Dielectric Object

Chairmen : Quentin CARAYOL , Frank WEINMANN

Contacts: quentin.carayol@dassault-aviation.com, weinmann@fgan.de

1. Definition of the Geometry

The target is a dielectric cube with side length $a = 12$ cm, which has also been manufactured from PVC material. The cube centre and the phase centre are assumed to be located at $(x,y,z) = (0,0,0)$.



2. Simulation Parameters

The time dependency is assumed to be $\exp(j\omega t)$.

The object described above shall be studied at the frequency $f = 30$ GHz. At this frequency, the relative permittivity of the material is approximately $\epsilon_r = 2.7$. For all simulations, $\epsilon_r = 2.7 - j 0.01$ shall be assumed.

Case (a): Monostatic RCS of the dielectric cube

The monostatic RCS shall be simulated at the frequency $f = 30$ GHz in the azimuth plane ($z = 0$, $\phi = 0^\circ \dots 90^\circ$, $\Delta\phi = 0.25^\circ$) for both vertical polarisation ($\theta\theta$ -polarisation, i.e. \mathbf{E} perpendicular to the xy -plane) and horizontal polarisation ($\phi\phi$ -polarisation, i.e. \mathbf{E} field in the xy -plane).

Case (b): ISAR image of the dielectric cube

For the dielectric cube, the RCS shall be simulated in the frequency range from 25 to 35 GHz with $\Delta f = 50$ MHz (i.e. 201 frequencies) for the azimuth angles $\phi = 0^\circ \dots 45^\circ$, $\Delta\phi = 0.25^\circ$ (i.e.

181 angles) for both polarisations ($\theta\theta$ -polarisation and $\phi\phi$ -polarisation). Due to the symmetry of the object, a full ISAR image can be generated from these data.

3. Data Formats

The results will be stored in one ASCII file for Case (a) and one ASCII file for Case (b).

Case (a) :

The file will contain on each row the data :

$$(\phi, \sigma_{\theta\theta}, \sigma_{\phi\phi})$$

where ϕ is the angle in degrees, $\sigma_{\theta\theta}$ and $\sigma_{\phi\phi}$ are the RCS in dBsm in $\theta\theta$ -polarisation and $\phi\phi$ -polarisation.

Case (b) :

The file will contain :

$$(f, \phi, \text{Real}(\sigma_{\theta\theta}), \text{Imag}(\sigma_{\theta\theta}), \text{Real}(\sigma_{\phi\phi}), \text{Imag}(\sigma_{\phi\phi}))$$

where f is the frequency in GHz, ϕ is the angle in degrees, $\text{Real}(\sigma_{\theta\theta})$, $\text{Imag}(\sigma_{\theta\theta})$, $\text{Real}(\sigma_{\phi\phi})$, $\text{Imag}(\sigma_{\phi\phi})$ are the real and imaginary part of the RCS in $\theta\theta$ -polarisation and $\phi\phi$ -polarisation.