Scattering from Coated Missile

In this application note, a comparison between monostatic scattering from metallic missile and coated missiles will be presented. In order to demonstrate capabilities of WIPL-D software, three models of missile will be created and simulated.

Models and Results

The missiles are modeled using **WIPL-D Pro CAD**. WIPL-D Pro CAD software is suited for **easy and fast creation of complex 3D geometry models**. It allows **importing** models from **various CAD formats**. It also allows creating models from the scratch using built-in primitives. For this particular case, the models of missile have been built from the scratch using WIPL-D Pro CAD. The dielectric layers were added using **WIPL-D Pro**. They are added by using *Copy\Layer* manipulation.

Copy\Layer manipulation is applied after meshing the CAD model. It enables modelling of arbitrary thin layer where both surfaces of the layer are meshed in the same way. The same meshing of the close surfaces is very important due to accuracy of geometry modelling and due to simulation accuracy.

Metallic model of the missile is shown in Figure 1. The model of missile is modified by coating the missile with a dielectric layer. Furthermore, one more dielectric layer is added to the model of the missile. Model of the missile coated with two dielectric layers is shown in Figure 2. The scattering results obtained using three different models are compared in Figure 3.

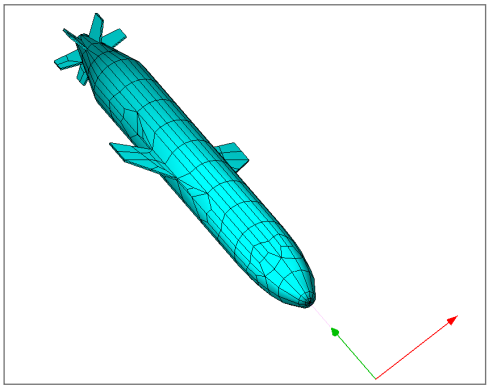

Figure 1. Metallic model of the missile

Table 1. Number of unknowns, computer memory required and simulation times

Model	Number of unknowns	Memory [GB]	Simulation time [sec]
Metallic missile	12,208	1.1	36
Metallic missile with one dielectric layer	36,992	10.2	420
Metallic missile with two dielectric layers	114,480	97.6	4,011

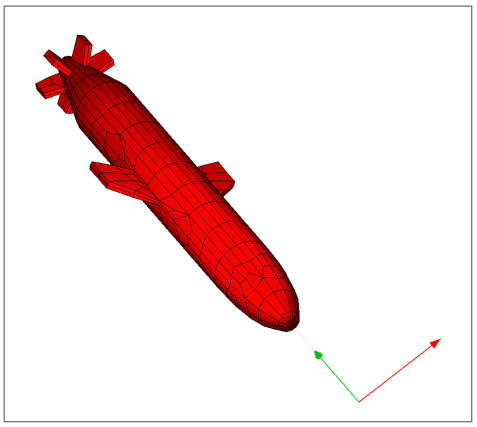

Figure 2. Metallic model of the missile coated with two dielectric layers

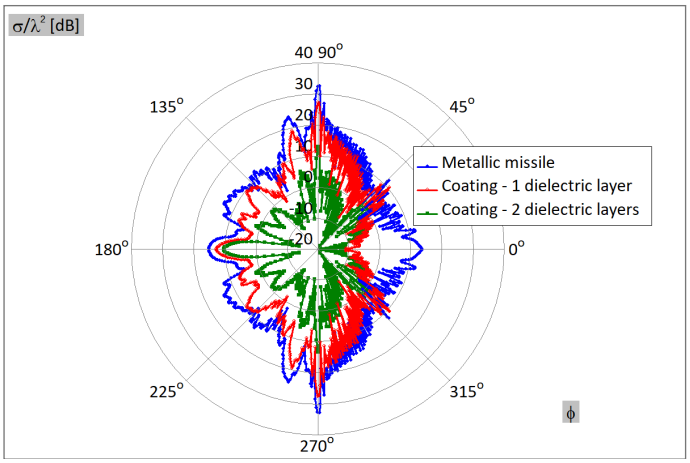

Figure 3. Metallic missile and coated missiles - scattering

Simulations

The simulations were carried out on the platform: Intel® Core™ i7-7700 CPU @ 3.60 GHz with 64 GB RAM and NVIDIA GeForce GTX 1080 GPU card. CPU is used for matrix fill, while GPU is used for matrix inversion.

Numbers of unknowns, computer memory required and simulation times are presented in Table 1. Simulation time is a sum of three intervals: time spent in matrix filling, time spent in matrix inversion and time spent in calculation of radiation pattern. In any simulation scenario, time required to calculate a radiation pattern is negligible compared to both, matrix filling time and matrix inversion time.

The **matrix is inverted using LU decomposition** which demands only inexpensive forward and backward substitution. That's why **monostatic analysis with many excitations is performed very fast** with WIPL-D.