Create Accurate EM Antenna Models

This software tool can produce electromagnetic (EM) models of antennas for use in higher-level simulations.

RF/microwave engineers are well-acquainted with "black box" models that characterize components in terms of S-parameters. These models, when incorporated into design software tools, enable engineers to conduct higher-level simulations. However, creating similar models of antennas has proven to be a more difficult task.

One company, the Microwave Vision Group (MVG), is focused on providing accurate electromagnetic (EM) models of measured antennas. The models can then be exported to various computational electromagnetic (CEM) software tools, allowing for simulations of complex environments. Because such antenna models can be used to represent a measured source in numerical simulations of complex scenarios, they essentially link numerical simulations and antenna measurements. As a result, it becomes possible to analyze deployed antenna performance in complex scenarios.

The INSIGHT software developed by MVG can be used to create EM models based on an antenna's measured radiation pattern. By post-processing the measured data, the software can generate an Equivalent Current (EQC) model. This model, which is in the form of a black box, is based on Huygens' formulation. The equivalent antenna model can then be exported to a number of CEM tools from vendors such as Altair (www.altair.com), ANSYS (www.ansys.com), Computer Simulation Technology (CST; www.cst.com), and others *(see figure)*.

Specifically, the measured radiation pattern, which can be near-field and/or far-field data, is subsequently loaded into INSIGHT. After loading of the measurements, the next step involves configuring the measurement data and the geometry. INSIGHT can then perform measurement post-processing, providing users with 3D visualization and current animations. The measured field and the fields reconstructed from equivalent currents are visualized.

One example of this scenario is a reflector system fed by a dual-ridge horn. The system consists of the horn, which is the source antenna, and the reflector. Once the radiation pattern of the horn itself is initially measured, the measured data can be post-processed to obtain an equivalent black-box model. This model can then be exported to a CEM tool to simulate the entire reflector system.

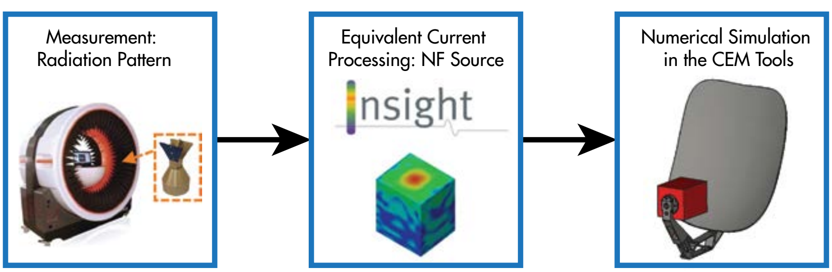
VALIDATING THE TECHNIQUE

MVG's white paper, "Finding the Missing Link: Bringing Together Numerical Simulation and Antenna Measurement to Understand Deployed Antenna Performance," discusses the case scenario of a flush-mounted monocone antenna on a flat structure. This analysis is presented to validate the link between antenna measurements and CEM simulations.

The validation structure consists of MVG's SMC2200 monocone antenna mounted on a flat structure. Measurements were performed with the StarLab measurement system. The measured data is then post-processed by INSIGHT to create a 3D EM model of the monocone antenna. Next, the model is exported to six different CEM simulators to simulate the plate with the monocone antenna. Simulations are performed at 5.28 GHz.

The results of each simulation are compared with a reference measurement. If the peak directivities of all simulations are close to the measured value, it demonstrates a successful validation. Directivity radiation patterns at 5.28 GHz are also presented, illustrating agreement between measured and simulated results.

The Microwave Vision Group; www.mvg-world.com



This figure illustrates the steps needed to incorporate an EM antenna model into a numerical simulation.