Success Story

University of Bath PhD Student Designs Antenna Array for Locating GPS Interference

"For my 3D antenna design, it was easy to see the entire antenna pattern with the Analyst 3D EM software viewer, which revealed problems that never would have been noticed using just a 2D view. This allowed me to focus on the designs that showed promise, reducing the amount of testing required."

Elizabeth M. Lloyd, PhD Student, University of Bath

Company

The University of Bath in Bath, United Kingdom, received its royal charter in 1966 and is now a top 10 UK university with a reputation for research and teaching excellence. The university's mission is to educate its students to become future leaders and innovators, benefiting the wider population through research, enterprise, and influence. University of Bath specializes in electronic and electrical engineering research.

Challenge

Global positioning systems (GPS) are ubiquitous in modern life, but unfortunately, the high frequency and low power of GPS signals, which makes them so cost effective and therefore prevalent, also renders them easy prey for low-cost "privacy protection devices," or signal jammers, that enable the avoidance of GPS tracking. Many applications are being developed to locate these signal jammers that are the source of GPS interference, but most methods for locating RF emitters require large systems with high-power consumption. In order to build a lower-power system capable of finding emitters based solely on the power in the signal, a suitable antenna must be designed.

Elizabeth Lloyd, PhD student at University of Bath, was challenged in her doctoral research project to design a low-cost antenna array composed of identical patches tuned to the right frequency and having a beam pattern suited to the location of RF emitters causing GPS interference. A geometry of two planar antennas and one 3D antenna was proposed, consequently Lloyd needed both a planar electromagnetic (EM) simulator and a full 3D EM simulator for her project.

Solution

Lloyd chose the NI AWR Design Environment platform for her design, specifically Microwave Office circuit design software, which provided both the AXIEM planar method-of-moments (MoM) and Analyst™ 3D finite-element method (FEM) EM solvers needed for her array composed of two planar antennas and a third 3D antenna.

At-A-Glance

Application
- Antenna

Software
- NI AWR Design Environment
- Microwave Office
- AXIEM
- Analyst

Benefits
- Availability of software
- Reduction in design time
- Proficient support services

After attending a training course delivered by Dr. John Dunn, EM technologist at AWR Group, NI, Lloyd drew up her designs, but the results from the 3D design were not what was expected. With the Analyst 3D viewer, she was able to easily see the entire antenna pattern, which revealed problems that never would have been noticed using just a 2D view. This allowed her to focus on the designs that showed promise, reducing the amount of testing required. Figure 1 shows the Analyst 3D layout of the antennas.

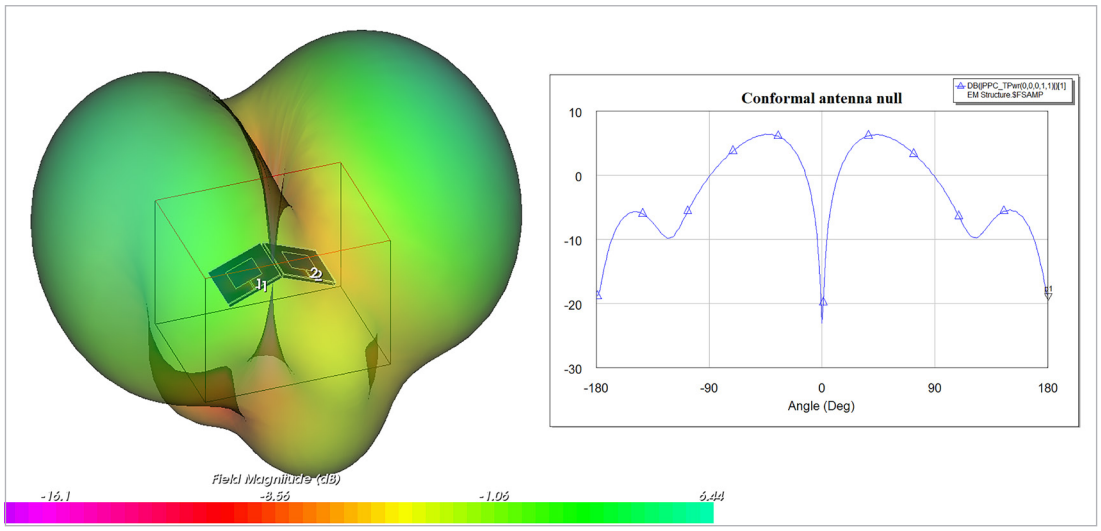

Figure 1: 3D layout of antennas in Analyst showing the radiation pattern and simulation results.

As a result of her work, Lloyd and fellow student Robert J. Watson published a paper[1] on her antenna designs, which was presented at the European Conference on Antennas and Propagation (EuCAP). Her research has quickly progressed to the next stage.

Conclusion

NI AWR software was chosen for this project for two main reasons. The first was that through its university program, the University of Bath's electrical engineering students have free access to the software and all the tutorials. The second was due to the outstanding quality and accessibility of training and support, specifically Dr. Dunn's three-day training course, as well as the technical support assistance of Andy Wallace, UK Country Manager for AWR Group, NI.

1. An Array Antenna for Low-Power Localization of GPS Interference, by Elizabeth M. Lloyd and Robert J. Watson, is available at: researchportal.bath.ac.uk/en/publications/an-array-antenna-for-low-power-localisation-of-gps-interference.

Special thanks to Elizabeth M. Lloyd for her contributions to this success story.