Probe Station Antenna Range

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Date: July 23, 2004

This summer I was given the task of programming a Probe Station to collect near field antenna patterns and convert them to far field patterns. The purpose of this project is to provide NASA with another means of antenna characterizing. Currently, NASA Glenn can measure near field and far field patterns of many different types of antennas. The antennas targeted for this lab are small patch antennas at high frequencies that require probe biasing. The Probe Station contains two probes for RF signals and another two for DC Biasing. The way this lab works is as follows: A patch antenna is placed on the probe station and biased properly for testing. This antenna is known as the Antenna Under Test (AUT). The AUT is supplied with an RF signal from a probe that is connected to a network analyzer. Above the AUT hangs a probe for measuring the electric field emitted by the AUT. The probe is controlled by four axis. The axis of movements for this probe are back and forth, left and right, up and down, and rotation. The network analyzer and axis controllers are tied into a computer for reading commands and recording data. The probe scans a rectangular pattern above the AUT to measure the electric field emitted by the AUT. This data is then recorded and analyzed back at the computer.

When I arrived here most of the hardware for the lab was already installed. I was given a complete overview of how everything runs and asked to integrate everything in LabVIEW.

From my work this summer a user is now capable of taking a near field antenna scans of many types of patch antennas and converting this to the more important far field pattern in LabVIEW. This program was designed to measure both linear and circularly polarized antennas. My goal for this project was to automate and prevent the user from seeing everything done behind the scenes. This goal proved harder than I had originally thought because I came to learn that to accomplish everything I would need to make use of several applications. LabVIEW is important for hardware control and data acquisition, but when it comes to analysis and display I had to look elsewhere. The conversion of the near field data to far field data is done in Matlab. I was able to integrate Matlab into LabVIEW so that the user wouldn't need to do this them self. Another important feature not capable from LabVIEW was providing the user with an unlimited

number of graph displays. I wanted the user to be able to conduct a scan and be able to choose from a collection of different graphs to display relative to the scan. For a typical scan on a linear patch antenna the user has 24 different types of graphs they can view. In LabVIEW you can only display as many graphs as you code into the program. With 24 different graphs you would either need to exclude some or take up much needed panel space in LabVIEW. To solve this problem I knew I would need to come up with a method to allow the user to open multiple graphs each in their own window. This was accomplished by creating a graphing program in Visual Basic and executing it from LabVIEW. To keep everything uniform I needed to integrate the graphing features of LabVIEW into Visual Basic which took some time to figure out.

This Probe Station antenna range is almost complete. Currently I'm working on safe guards such as making sure a scan isn't attempted when equipment may be off. This antenna range has been tested using predictable horns and observing that the results are what was expected.

The remaining time here I'll finish tweaking and improving the antenna range. A technical memorandum will be written to give exposure to the new capabilities NASA has from this range. I've been given flyers for different conferences that my mentors think would be good for me to apply a paper towards. I've also been asked to search the US Patent and Trademarks office to find out how unique this project is compared to what already exists.

In conclusion, my work this summer has been very beneficial to NASA and myself. NASA has gained the capability of further antenna testing through the use of a new lab and I've been exposed to a number of different programs. I was told what the antenna range should be able to do and was free to implement it however I chose. This allowed me to think creatively without being limited to certain specs. It also forced me to think as a designer. I needed to put myself in the position of the user and make certain my program was the easiest to use along with being robust enough to allow meaningful and useful data analysis and presentation.