ECE Faculty Member receives NSF Grant

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CLEMSON UNIVERSITY – Electrical and Computer Engineering Professor Xiao-Bang Xu has been awarded a National Science Foundation grant to study the electromagnetic scattering of 3-D objects buried in stratified earth. The $283,814 grant resulted from a proposal to the Electrical, Communications and Cyber Systems division of NSF.

Dr. Xu's goal is to develop and then employ an efficient hybrid numerical technique based on pseudospectral time-domain (PSTD) method with Monte-Carlo simulation to investigate the scattering of an object buried in a stratified earth with multiple random rough interfaces.

This research may benefit society through a number of important potential applications, including:

- geophysical exploration of mineral deposit, petroleum, and alternative energy resources such as geothermal spots;
- locating buried hazardous waste for environment protection;
- detection of subsurface targets such as landmines for protection of our troops;
- nondestructive testing of underground pipes and other underground facilities;
- microwave imaging of abnormal area embedded in multi-layer biological structures for detection of cancers;
- modeling of indoor wave propagation through multi-layer walls for wireless internet planning.

The graduate and undergraduate students working with this project will gain experience in the area of modeling and computer simulation and the development and applications of numerical techniques. The research will also enhance three graduate courses.

The proposed research is more advanced than previous work in this area because it involves stratified media with *multiple* random *rough interfaces*, which can more realistically model the earth and other realistic layered structures that may be encountered in real-world applications.

The proposed numerical technique is based on the pseudospectral time-domain method, which is more efficient than the conventional finite-difference time-domain method, due to its significantly less computer time and memory requirement for the same or even higher accuracy, as illustrated by many published numerical experiment results.

The pseudospectral time-domain technique can also deal with complex geometry with a great flexibility, and has potential for parallel computations.

This is Dr. Xu's second NSF grant—his first was a $93,000 to study an improved method of computing zero-sequence impedance of underground cable from 1996 to 2000.