

# **Recent Developments in Computational Electromagnetics using The Finite Difference Time Domain Method**

**Atef Z. Elsherbeni**

Electrical Engineering Department, Colorado School of Mines  
Golden, CO 80401, USA

This presentation will focus on recent developments in the finite difference time domain (FDTD) method for electromagnetics and antenna applications. First a brief introduction to the method, its capabilities, and the type of lumped circuit elements, linear and non-linear, which can be integrated into an electromagnetic simulation will be presented. Several examples of designing, antennas, filters, and RFID tags will be demonstrated. Furthermore, the development of the cylindrical FDTD formulation, the body of revolution FDTD (BOR-FDTD) formulation to model rotationally invariant cylindrical structures, and the cylindrical-sectoral formulation to model partially rotational structures will be presented with special focus on integrating dispersive material analysis for real applications such as the oil and gas wireline logging. The speed up of the FDTD method using graphical processing gaming cards (GPUs) along with the use of different programming languages such as FORTRAN, MATLAB, CUDA, and OpenCL will be highlighted.