Antenna Modeling and Simulation Techniques – Full Wave and Asymptotic Solvers

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Abstract:
Now-a-days antennas have become an integral and important part of almost any wireless communication system. In the field of antenna engineering, theoretical analysis is of paramount importance in understanding the basics of the antenna radiation characteristics. While the basic concept of antennas is well known, closed form, exact analytical solutions to many antenna problems are not practical and impossible in many cases. Advances in electromagnetic (EM) simulations have significantly impacted the antenna design process by providing exact solutions by solving Maxwell's equations using numerical methods. It is a common practice now in academia and industry to use various commercially available EM simulation tools for antenna design process. In this short course, we will introduce basics of antenna modeling and simulation process with pros and cons of various numerical methods, such as Method of Moments (MoM), Multilevel Fast Multipole Method (MLFMM), Finite Element Method (FEM), Finite Difference Time Domain (FDTD), Physical Optics (PO), Ray Lunching Geometrical Optics (RL-GO), and Uniform Theory of Diffraction (UTD). We will then discuss modeling and simulation of various antenna types, starting from simple configurations such as dipoles and loops and eventually leading to more complicated and practical designs such as microstrip patches and high-gain reflector antennas.

Bio:
Dr. C.J. Reddy is Vice President, Business Development-Electromagnetics for Americas at Altair Engineering, Inc. Dr. Reddy was awarded the Natural Sciences and Engineering Research Council (NSERC) of Canada Visiting Fellowship to work at Communications Research Center in Ottawa during 1991-1993 and was awarded the US National Research Council (NRC) Resident Research Associateship in 1993 to work at NASA Langley Research Center in Hampton, Virginia. He also worked as a Research Professor at Hampton University from 1995 to 2000. Dr. Reddy was the President of Applied EM, Inc. (2000-2017), where he led several Phase I and Phase II SBIR projects for the DoD and NASA. He was also the President of EM Software & Systems (USA) Inc

(2002-2014) and led the marketing of the EM Simulation tool, FEKO, in North America. EM Software & Systems (USA) Inc. was acquired by Altair in 2014.

Dr. Reddy is a Fellow of IEEE, Fellow of ACES (Applied Computational Electromagnetics Society), and a Fellow of AMTA (Antenna Measurement Techniques Association). Dr. Reddy is a co-author of the book, “Antenna Analysis and Design Using FEKO Electromagnetic Simulation Software,” published in June 2014 by SciTech Publishing (now part of IET). Dr. Reddy served as an Associate Editor for the IEEE Open Journal of Antennas of Propagation and the IEEE Transactions on Antennas and Propagation. He served as the Chair of the IEEE Antennas and Propagation Society (AP-S) Young Professionals Committee during 2021-2024 and served on the AP-S AdCom during 2023-2024. Dr. Reddy is appointed to the IEEE Fellows Committee by the IEEE Board of Directors for the terms 2020-2021 and 2022-2023. Currently, Dr. Reddy is serving as the 2025 IEEE AP-S President-Elect. Dr. Reddy is inducted into the IEEE Heritage Circle by the IEEE Foundation for establishing the "*IEEE AP-S CJ Reddy Travel Grant for Graduate Students*."