



Short Course in Computer Modeling of Microwave Systems

4th World Congress on MW & RF Applications

Austin, TX ♦ November 7, 2004

Instructor: Vadim Yakovlev*)

Profile – The course briefly covers fundamental and practical issues in computer modeling of systems and processes in microwave (MW) power engineering and shows what modern advanced simulation can bring to engineers and designers of the microwave heating applications. The emphasis is made on the advantages of the conformal Finite Difference Time Domain method and its implementation in *QuickWave-3D*, the 3D conformal FDTD EM simulator. Examples of modeling of practical applicators and their elements are presented. The participants work with their laptops (on which *QuickWave-3D* is installed for the duration of the course) to get hands-on experience and appreciate the meaningfulness of modeling of applied MW systems.

Course Syllabus

9:00 – 10:00 am:	1. Computational Electromagnetics: Basics of Numerical Analysis Introduction to the course. Related theoretical points in electromagnetics. Conceptual aspects of EM modeling: <i>why's</i> , <i>what's</i> and <i>how's</i> . Maxwell's equations. Major numerical techniques. FDTD and FEM.
10:10 – 10:50 am:	2. Electromagnetic Simulators & Concepts of Modeling of Microwave Heating Database of EM software applicable to modeling of microwave heating scenarios. Test problem solved by different simulators; recommended solvers. Strategic objectives of modeling.
11:00 – 12:10 am:	3. Computational Strategy & Its Practical Implementation with <i>QuickWave-3D</i> Computational strategy of FDTD modeling of microwave heating. Relevant aspects of high frequency electromagnetics. Building projects in <i>QuickWave-3D</i> and mesh control.
12:10 – 1:30 pm:	Break: Lunch & Installation of <i>QuickWave-3D</i>
1:30 – 2:50 pm:	4. Examples of Practical Modeling & Optimization Simulation of components and applicators: high power water loads, slotted radiating element. System optimization: ETAC applicator and GAE 5.8 GHz dry load. Direction of advanced modeling; thermal coupling.
3:00 – 4:00 pm:	5. Making <i>QuickWave-3D</i> Models: Basic Concepts & Element Approach Practical work with the software: creation of element models from scratch (including discretization and excitation): MW domestic oven with a food load. Computation with a pulse and sinusoidal excitation. Analysis of the software output.
4:00 – 5:00 pm:	6. Making <i>QuickWave-3D</i> Models: Object Approach & Post-Processing Practical work with the software: creation of object models from scratch: MW domestic oven or industrial batch system. Basics and merits of the UDO language. Import of SAT files.

*) The Industrial Microwave Modeling Group, Dept. of Mathematical Sciences, Worcester Polytechnic Institute, 100 Institute Rd., Worcester, MA 01609, USA, vadim@wpi.edu