Radlab Seminar

Dr. Frantisek Cajko

University of Akron

Friday, September 11th, 2009
4:00 PM – 5:00 PM
1005 EECS

Frantisek Cajko is a recent graduate of the University of Akron where he has received his PhD in electrical engineering. His main area of expertise is in numerical methods for electromagnetic modeling at nano-scale. Frantisek has received his MS degree in physics (2000) and a special degree in electronics (2002) from Comenius University in Bratislava, Slovakia. Then he joined the university in Bratislava as a lecturer and a research fellow. His work was oriented on pulse measurements of the magneto-elastic phenomenon and development of the measuring device for commercial applications. In 2004, he has become a student of Dr. Igor Tsukerman and came to Akron, OH, where he was involved in the development of Flexible Local Approximation Method (FLAME), simulation of plasmonic and negative index materials and in electromagnetic modeling of nano- and micro-scale systems, mainly, analysis and optimization of atomic force microscope (AFM) probes used in the Scanning Near-Field Optical Microscopy (SNOM). The research was conducted in cooperation with the groups of Dr. A.Sokolov (College of Polymer Science and Polymer Engineering, the University of Akron) and Dr. F.Keilmann (Max-Planck-Institut fur Biochemie, Martinsried, Germany), and the results have been published in several referred journals.

Near-Field Focusing of Light at Optical and Infrared Frequencies

Over the past decade, there has been an ever increasing interest in Scanning Near-Field Optical Microscopy (SNOM) which has the ability to deliver subwavelength resolution. My work is focused on the simulation of apertureless probes that take advantage of the strong field amplification in the vicinity of a sharp object, such as an AFM probe. At optical frequencies, the enhancement can be further increased by a plasmonic coating. Both plasmon-enhanced and scattering-type SNOM are considered in this presentation. Optical and near-infrared simulations of SNOM probes exemplify the numerical challenges due to the multi-scale nature of the problem. The finite element method (FEM) with adaptive meshing will be shown as a practical method of full 3D analysis of AFM probes at the mid-infrared frequencies.

The second part of the talk will be more numerically oriented. After a short introduction of the Flexible Local Approximation Method (FLAME), which is a generalized finite difference (FD) method, the numerical difficulties of modeling Veselago's double-negative materials caused by the standard flux balanced schemes will be explained, and the FLAME approach used to overcome these difficulties will be described. Examples for planar interfaces will be presented.