Short Course **Day 1: Tuesday, 23 Nov. 2010**

Venue: Capri Hall

Short Course 2

Design, Analysis and Practical Applications of RFID Antennas

Prof. Raj Mittra
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Prof. Andrey S. Andrenko

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10:00 – 12:30

Abstract

Radio frequency identification (RFID) technology employs short-range wireless communications to read certain digital information stored in a tag attached to an object being tracked. An RFID system consists of one or more tags with IC chips, and a read/write (R/W) device incorporating an R/W antenna as its main component. Tags come in many sizes and shapes, but they are usually small and lightweight, and are typically used for wireless data communication with R/W devices at distances ranging from a few millimeters to several meters.

This short course will cover all the technical aspects of UHF band RFID antenna design and applications. It will begin with a detailed introduction of the basic principles of wireless communications as incorporated in real-life RFID systems. Next, the performance requirements of various R/W antennas for RFID systems would be presented. To provide simultaneous signal reception from arbitrarily oriented linearly polarized tags an R/W antenna is typically designed to be circularly polarized (CP), with its polarization characterized by the axial ratio (AR), although it is possible to use linearly polarized (LP) R/W antennas in some RFID systems. Several designs of CP and LP R/W antennas, as well as RFID tag antennas will be presented and their implementation in various RFID systems will be described. Some of the topics to be covered are listed below:

1. Design and optimization of high-gain single feed RHCP and LP parasitic R/W patch antenna.

2. RHCP and LP 2-element dipole-on-glass R/W antenna for show case applications.

3. Design and system integration of printed-on-glass RHCP R/W gate patch antenna.

4. Environmental effects on the performance of high-gain RHCP R/W patch antenna located outdoors.

5. Simulation and design of custom-made RFID tag antennas and their implementation.

6. Design of platform tolerant tags, including those operating efficiently when placed on metallic objects.

7. Example of special-purpose RFID tags, e.g., those designed for libraries.

8. Tracking and measuring speeds of moving RFID tags.

About the speakers

Raj Mittra is Professor in the Electrical Engineering department of the Pennsylvania State University. He is also the Director of the Electromagnetic Communication Laboratory, which is affiliated with the Communication and Space Sciences Laboratory of the EE department. Prior to joining Penn State he was a Professor in Electrical and Computer Engineering at the University of Illinois in Urbana Champaign. He is a Life Fellow of the IEEE, a Past-President of AP-S, and he has served as the Editor of the Transactions of the Antennas and Propagation Society. He has been awarded the Guggenheim Fellowship, the IEEE Centennial and Millennium Medals, the IEEE/AP-S Distinguished Achievement Award and the AP-S Chen-To Tai Distinguished Educator Award, and the Electromagnetics Award of the IEEE. He has over 1,000 publications to his credit, as well as more than 30 books or book chapters on electromagnetics, antennas, microwaves and electronic packaging. He has supervised over 100 Ph.D. theses, an equal number of M.S. theses, and has mentored over 50 postdocs.

Andrey S. Andrenko was born in Kharkov, Ukraine, in 1964. He received the MS and PhD degrees in Radio Physics and Electronics from Kharkov State University, in 1986 and 1992, respectively. He was a Research Engineer and a Research Scientist with the Institute of Radio Physics and Electronics National Academy of Sciences of Ukraine from 1986 to 1998. From 1993 to 1996, he was an Assistant Professor at the University of Gaziantep, Turkey. He was a Research Fellow of JSPS at the Tokyo Institute of Technology, Japan, from 1996 to 1998. From 1998 to 2001, he worked as a Research Engineer with Information Technology R&D Center, Mitsubishi Electric Corp, Kamakura, Japan, where he developed novel RF active-integrated antennas and amplifiers for 3G wireless applications.

Since 2001, Dr. Andrenko is the Principal Researcher at Fujitsu Laboratories LTD., Yokosuka, Japan, providing technical leadership in the areas of advanced antennas and wireless components. During his time at Fujitsu Laboratories, he has lead several antenna analysis and design projects on antenna systems for vehicular-based mobile communications, RFID systems, and mobile handset applications. Dr. Andrenko has published more than 60 technical papers and holds 19 US patent awards/filings. His research interests include computational electromagnetic methods, novel antenna design, RFID applications, and wireless communication technologies.

He has been a reviewer for IEEE AP Transactions since 2000, a reviewer for IEEE AWPL since 2002, and a reviewer for IET Microwaves, Antennas & Propagation since 2008. Dr. Andrenko is a Senior Member of the IEEE.