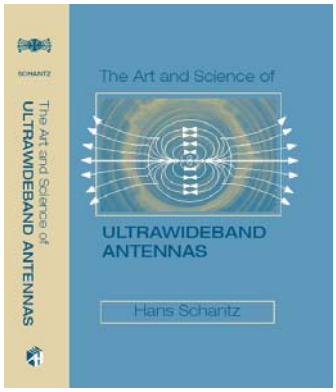
Workshop: The Art and Science of UWB Antennas

Dr. Hans Schantz



The imminent wide scale commercial deployment of ultra-wideband (UWB) systems has led to increased interest in UWB antenna designs. In many cases, though, investigators have unknowingly resurrected already known designs rather than developing new ones. Also, the subtleties of UWB antenna design are not always obvious to those more familiar with narrowband design. For instance, the spectral and impedance matching properties of a UWB antenna exert a profound influence on an overall UWB system design.

This workshop will enable attendees to:

- Quickly and correctly apply UWB antennas to current projects
- Design and analyze UWB antennas
- Integrate these antennas in an RF system

Based on the author's 2005 text, this workshop is available in a full day (eight hour) format presenting nearly 500 slides.

Outline

I. Introduction & Overview
- A. Overview
- B. Historical Background
- C. What is an Antenna?

II. Basic Concepts:
Antennas as Transducers
- A. Bandwidth
- B. Dispersion
- C. Where Energy Goes?
- D. Polarization
- E. Basics of Matching

III. Impedance & Matching:
Antennas as Transformers
- A. Antenna Impedance
- B. Transmission Lines
- C. Matching
- D. Impedance Transformers
- E. Balun Transformers
- F. Antennas as Transformers

IV. Time Domain Electromagnetics:
Antennas as Radiators
- A. Time vs. Frequency Domain
- B. Maxwell's Equations
- C. Linear Antennas
- D. Dipole Fields
- E. Antennas as Radiators

V. Time Domain Energy Flow:
Antennas as Energy Conversion Devices
- A. Motivation
- B. Localizing EM Energy
- C. Optimizing Antenna Elements
- D. Antennas: Energy Converters

VI. Antenna Taxonomy
- A. Frequency Independent
- B. Small Elements (Electric)
- C. Small Elements (Magnetic)
- D. Electrically Small Antennas
- E. UWB Antenna Arrays
- F. Horn Antennas
- G. Reflector Antennas

VII. System & Network Considerations
- A. Spectral Control and Shaping
- B. UWB Antenna Efficiency
- C. Directivity & UWB Links

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Course History

Initially presented February 2004 in Oulu, Finland at the Centre for Wireless Communications (about 30 attendees).

Full-length version presented July 2004 in Monterey, CA, USA at the IEEE APS Conference (about 35 attendees).

Full-length version presented July 2005 in Washington, DC, USA at the IEEE APS Conference (about 25 attendees).

Half-length version presented September 2005 in Zurich, Switzerland at the ICU 2005 Conference (about 30 attendees).

Half-length version presented January 2006 in San Diego, CA at the IEEE RWS 2006 Conference (about 20 attendees).

This short course is consistently one of the top attractions at the annual IEEE APS Conference. The full-length version of this course has not been presented in Europe since 2004. The associated book is one of Artech House's best selling titles and is already into a second printing after having been on the market less than a year.

Biography

Dr. Hans Schantz is a consulting engineer with Next-RF, Inc. a Huntsville, AL (USA) based corporation specializing in UWB antenna products, custom designs, consulting, and intellectual property (www.UWBAntenna.com). Author of ***The Art and Science of Ultrawideband Antennas*** (Artech House 2005), Dr. Schantz has published work in the American Journal of Physics, IEEE Antenna and Propagation Magazine, and IEEE Aerospace and Electronics Systems Magazine. He has a couple dozen conference papers, over a dozen US patents to his credit, and over a dozen pending patent applications. Dr. Schantz is founder and chief scientist of the Q-Track Corporation (www.q-track.com), a start-up company pioneering a narrowband, low frequency, low cost, high accuracy positioning technology called "Near Field Electromagnetic Ranging." He is also a Senior Member of the IEEE.

Dr. Schantz holds a BSIE in industrial engineering and a BS in the honors curriculum in physics both from Purdue University, West Lafayette, IN. He earned his Ph.D. in physics from the University of Texas, Austin. His career has included employment with IBM, the Lawrence Livermore National Laboratory, the ElectroScience Laboratory of the Ohio State University, and the Time Domain Corporation.

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