



**Antennas – Design and Technology TGI Structured PhD Module**  
**Dublin Institute of Technology, Kevin St, Room 403**  
**Monday 18th June to Friday 22nd June**

**Monday June 18<sup>th</sup> 09.00 – 17.30.**

**08.45 Registration**

**09.10 Introduction: Prof Max Ammann**

**09.15 Fundamental Antenna Concepts Dr Steve Best**

Basic antenna property definitions, (Impedance, return loss, directivity, radiation patterns, polarization)  
Antenna Classes, (Resonant antennas, traveling wave antennas, electrically small antennas)  
Classification of antenna types (By frequency, by size, by directivity, etc.)

**11.00 Break**

**11.15. Fundamental Antenna Elements (1) Prof Vince Fusco**

Elementary antennas, The Hertzian Dipole, Hertzian dipole radiation pattern, directivity  
Dipole antenna of finite length, Finite length Dipole radiation pattern  
Dipole antenna radiation resistance, Concept of antenna gain

**12.30 Lunch**

**13:30 The Propagation Channel (1) Prof Vince Fusco**

Propagation considerations, Path loss, Link budget calculations

**15.15 Break**

**15:30 The Propagation Channel (2) Dr Steve Best**

Reflection, multipath and fading, Ionospheric Effects, Diversity

**16:30 Break**

**16:45 Fundamental Antenna Elements (2) Dr Steve Best**

Other antenna types, (The monopole, loop, folded dipole, slot), microstrip patch, Baluns, Ground plane considerations, (Vertically polarized elements, horizontally polarized elements)

**17.30 Close**

**Tuesday June 19<sup>th</sup> 09.00 - 18.00**

**09.00 Antenna Elements I Dr Steve Best**

Circularly polarized antennas, (The helix, crossed dipole, microstrip patch, quadrifilar helix), Aperture antennas (Aperture concepts, the horn, reflector antennas). Impedance Matching, Broadband and frequency independent antennas, (Broadband dipoles, the log-periodic antenna, the spiral antenna)

**10.30 Break**

**11.00 Numerical Modeling of Antennas / Dr Steve Best**

NEC (Numerical Electromagnetics Code), CST Microwave Studio

**12.30 Lunch**

**13:30 Practical: Introduction to Computer Simulation Technology/Design Examples  
(Dr Steve Best/Dr Giuseppe Ruvio, Dr Matthias John)**

**15.30 Break**

**16.00 Practical: Introduction to Computer Simulation Technology/Design Examples  
(Dr Steve Best/Dr Giuseppe Ruvio, Dr Matthias John)**

**17.30 Close**

## Wednesday June 20<sup>th</sup> 09.00 - 18.00

- 09.00** **Advanced Antenna Concepts** **Dr Steve Best**  
Friis and radar range equations, Receive and scattering properties of antennas, Antenna phase center, Antenna and system noise temperature
- 10.30 Break**
- 11.00** **Electrically Small Antennas I** **Dr Steve Best**  
Defining electrically small, Achieving self-resonance with electrically small antennas
- 12.30 Lunch**
- 13.30** **Solving Maxwell's Equations in the Time and Frequency Domain using Commercial Software** **Dr Mohan Jayawardene, Dr. Arnab Bhattacharya, CST GmbH**
- 15.15 Break**
- 15.45** **Practical: Solving Antenna problems both in the Time and Frequency domain, Antenna modelling using imported CAD drawings, Circuit and EM co-simulation**
- 17.30 Close**

## Thursday June 21st 09.00 - 18.00

- 09.00** **Electrically Small Antennas II** **Dr Steve Best**  
Design and optimization of electrically small antennas, Recent designs and advances in the design of small antennas
- 10.30 Break**
- 11.00** **Antenna Elements II** **Dr Steve Best**  
Fractal antennas, RFID antennas, Ultra-wideband (UWB) antennas, The PIFA, Device integrated antennas, Electromagnetic bandgap (EBG) ground planes, Defining electrically small, Achieving self-resonance with electrically small antennas
- 12.30 Lunch**
- 13.30** **Phased Arrays I** **Dr Steve Best**  
Array theory, Electronically steered arrays
- 15.15 Break**
- 15.45** **Practical: Practical: Computer Simulation Technology/Design Examples and Design Assignment Part I (Dr Steve Best, Dr Matthias John, Dr Giuseppe Ruvio, Dr Patrick McEvoy)**
- 17.30 Close**

## Friday June 21st 09.00 - 16.00

- 09.00** **Phased Arrays II** **Dr Steve Best**  
Mutual coupling between elements, Dipole arrays, Superdirectivity
- 10.30 Break**
- 11.00** **Antennas used in Communication and Radar Systems** **Dr Steve Best**  
Overview of antenna types, Design examples
- 12.30 Lunch**
- 13.30** **Practical: Practical: Computer Simulation Technology/Design Examples and Design Assignment Part II (Dr Steve Best, Dr Matthias John, Dr Giuseppe Ruvio, Dr Patrick McEvoy)**
- 15.00 Close**



## **Bibliographies:**

**Steven R. Best** is a Principal Sensor Systems Engineer with the MITRE Corporation in Bedford, MA. He received the B.Sc.Eng and the Ph.D. degrees in Electrical Engineering in 1983 and 1988 from the University of New Brunswick in Canada. Dr. Best has over 23 years of experience in business management and antenna design engineering in both military and commercial markets. Prior to joining MITRE, Dr. Best was with the Air Force Research Laboratory (AFRL) at Hanscom AFB, where his research interests included electrically small antennas, wideband radiating elements, conformal antennas, antenna arrays and communications antennas. Prior to joining AFRL, he was President of Cushcraft Corporation in Manchester, NH from 1997 to 2002. He was Director of Engineering at Cushcraft from 1996 to 1997. Prior to joining Cushcraft, he was co-founder and Vice President and General Manager of Parisi Antenna Systems from 1993 through 1996. He was Vice President and General Manager of D&M/Chu Technology, Inc (formerly Chu Associates) from 1990 – 1993. He joined Chu Associates as a Senior Electrical Engineer in 1987.

Dr. Best is the author or co-author of 3 book chapters and over 100 papers in various journal, conference and industry publications. He frequently presents a three-day short course on antennas and propagation for Besser Associates, Inc., he is the author of a CD-ROM series on antenna theory and design, and he has presented several Besser Associates' Webinars on antenna topics. He has also authored an IEEE AP-S Expert Now module on electrically small antennas. Dr. Best is a former Distinguished Lecturer for IEEE Antennas and Propagation Society (AP-S), a former member of the AP-S AdCom, a former Associate Editor for the IEEE Transactions on Antennas and Propagation, and Senior Past Chair of the IEEE Boston Section. He is currently the AP-S Electronic Communications Editor-in-Chief. Dr Best is a Fellow of the IEEE.

**Vincent Fusco** obtained his Bachelors degree in Electrical and Electronic Engineering (First Class Honours) and his PhD in Microwave Electronics from the Queen's University of Belfast in 1979 and 1982 respectively. In 2000 he was awarded a DSc by Queen's University for his work on Advanced Front End Architectures with Enhanced Functionality, where since 1995 he has held a personal chair in High Frequency Electronic Engineering.

Professor Fusco has published 400 scientific papers in major journals and in referred international conferences, and is the author of two text books. He holds several patents and has contributed invited chapters to books in the field of active antenna design and EM field computation.

He is a Fellow of the Royal Academy of Engineering, Fellow of the Institute of Electrical Engineers IEE, Fellow of the Institute of Electrical and Electronic Engineers IEEE. In 1986 he was awarded a British Telecommunications Fellowship and 1997 he was awarded the NI Engineering Federation Trophy for outstanding industrially relevant research.

**Max Ammann** is the Director of the Antenna and High Frequency Research Centre at Dublin Institute of Technology and also leads the antenna research within Ireland's Telecommunications Research Centre (CTVR). He joined the DIT in 1986 following eight years of radio systems engineering and antenna design with TCL/Philips Radio Communications Systems in Dublin. He received his Ph.D. in antennas and propagation from Trinity College, University of Dublin, Ireland. He became a Chartered Engineer in 1986, a Member of the Institute of Electrical and Electronics Engineers in 1996 and is now a Senior Member IEEE. He was appointed senior lecturer in 2003.

Professor Ammann sits on the management committee of the EU COST Action IC0603, "Antenna Systems & Sensors for Information Society Technologies" (ASSIST) and is active in the Antenna Sensors and Systems Work Group. As a member of the IEEE International Committee for Electromagnetic Safety, he participated in the revision of the IEEE Std C95.1, 2005 standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. He is a committee member of the International Union of Radio Science (URSI) for Communications and Radio Science within the Royal Irish Academy, with expertise in Commission K: Electromagnetics in Biology and Medicine.

He has in excess of 200 peer-reviewed papers published in journals and international conferences. He was chair of the 4th Management Committee Meeting & Workshop on "Antenna Systems & Sensors for Information Society Technologies" in 2008 in TCD Dublin and chair for Antennas & Propagation for the 65th IEEE VTC, Dublin 2007 .