EUROPEAN SCHOOL OF ANTENNAS (ESoA) 2016

SHORT RANGE RADIO PROPAGATION: THEORY, MODELS AND FUTURE APPLICATIONS

University of Bologna – Cesena Campus (Italy) - September 26-30, 2016

(source: http://www.cs.unibo.it/~ghini/cesena.html)

In the context of the European School of Antennas 2016, the course on *Short range radio propagation* is scheduled for the end of September at the University of Bologna, Italy. The course will take place at the university campus located in Cesena, at nearly 15 km from the Adriatic Sea.

The course will deal with channel modelling for medium/short range wireless systems and services, including millimetre wave and Terahertz radio propagation for 5G, as well as aspects related to MIMO and UWB technologies for wireless body area networks, medical and short range radar applications.

The lecturers are from University of Bologna, Technische Universität Braunschweig, Dublin City University, Karlsruhe Institute of Technology, Université Catholique de Louvain and Polaris Wireless (CA, USA).

The course is supported by the European COST Action 15104 "IRACON" and by the Guglielmo Marconi Foundation.

For registration, please fill up the payment form and send it to: franco.fuschini@unibo.it AND esoa2016@fgm.it.

Further info:	http://www.antennasvce.org/Community/Education/Courses?id_folder=630

Course fees:	University Students (full time Master or PhD students):	440 €
	Any other participant:	880 €
	The fee includes tuition, course material, coffee breaks and a social event.	

Location:	"University of Bologna – **Cesena Campus**", Department of Computer Science and Engineering, via Sacchi 3, 47521 Cesena (Italy).

Contact:	Franco Fuschini, e-mail: franco.fuschini@unibo.it, phone: +390512093437

Course Schedule

8:30 – 9:30	Welcome, Introduction, Overview on radio channel modelling for wireless communications *Franco Fuschini - University of Bologna*
9:30-10.30	**Fundamentals of propagation and scattering I**: Maxwell's equations, electromagnetic waves in lossless and lossy media, polarisation, reflection, transmission and diffraction *Conor Brennan – Dublin City University*
10.30-11.00	Coffee break
11.00-12:00	**Fundamentals of propagation and scattering II**: Maxwell's equations, electromagnetic waves in lossless and lossy media, polarisation, reflection, transmission and diffraction *Conor Brennan – Dublin City University*
12:00-13:00	**Full wave techniques for wave scattering computation I**: FDTD, Discretisation and Stability, Courant condition, absorbing boundary conditions and perfectly matched layers, IE formulation and MoM, Fast Multipole Method and acceleration techniques, FEM *Conor Brennan – Dublin City University*
13:00-14:00	Lunch break
14:00-15:00	**Full wave techniques for wave scattering computation II**: FDTD, Discretisation and Stability, Courant condition, absorbing boundary conditions and perfectly matched layers, IE formulation and MoM, Fast Multipole Method and acceleration techniques, FEM *Conor Brennan – Dublin City University*
15:00-16:30	**Geometrical Theory of Propagation**: the concept of ray, rays trajectories, flux tube, divergence factor, ray polarization, geometrical description of electromagnetic interaction (reflection, transmission, diffraction, diffuse scattering). Multiple interactions and multipath *Franco Fuschini - University of Bologna*
16:30-17:00	Coffee break
17:00-18:00	Exercises *Conor Brennan – Dublin City University*

8:30–10:30	**Multipath propagation**: stochastic and multidimensional aspects, stationarity, Bello formalism (Channel Transfer Functions). Small-scale fading (Rayleigh, Rice, Doppler spectrum, spreading in time/angles, selectivity in frequency/space) *Claude Oestges - Université Catholique de Louvain*
10:30-11:00	Coffee break
11:00-13-00	**MIMO channels I**: MIMO channel matrix, Eigenmodes and eigenvalues, Analytical MIMO matrix representations (correlation matrix, Kronecker and eigenbeam models), Indoor MIMO channels (keyhole propagation) , MIMO channel dynamics, multi-link properties, MIMO antenna coupling *Claude Oestges - Université Catholique de Louvain*
13:00-14:00	Lunch break
14:00-15:00	**MIMO channels II**: MIMO channel matrix, Eigenmodes and eigenvalues, Analytical MIMO matrix representations (correlation matrix, Kronecker and eigenbeam models), Indoor MIMO channels (keyhole propagation) , MIMO channel dynamics , multi-link properties, MIMO antenna coupling

	Claude Oestges - Université Catholique de Louvain
15:00-16:30	**MIMO channel sounding techniques**: sounder architectures, parameter estimation (SAGE, Rimax, Kalman, etc.) *Claude Oestges - Université Catholique de Louvain*
16:30-17:00	Coffee break
17:00-18:00	Exercises *Conor Brennan – Dublin City University*

Wednesday 28/9

8:30–10:00	**Propagation for body area network**: on-body propagation, off-body and body-to-body propagation, stationarity and channel models *Claude Oestges – Université Catholique de Louvain*
10:00-11:00	**UWB propagation**: UWB channel definitions, UWB propagation, antenna and channel characteristics, UWB hybrid channel, True Time Delay, IR-Fidelity, UWB antenna principles *Werner Wiesbeck- Karlsruhe Institute of Technology*
11:00-11:30	Coffee break
11:30-13-30	**UWB applications:** UWB radar for precise, short-range measurement, UWB for medical applications *Werner Wiesbeck- Karlsruhe Institute of Technology*
13:30-14:30	*Lunch break*
14:30-16:30	**Implementation of a ray based prediction tool**: digital description of antennas and environments, ray tracing (RT) and ray launching (RL), tracking of rays trajectories, field computation along the rays, computational cost and prediction accuracy. Potential and limitations of RT/RL *Vittorio Degli Esposti – Polaris Wireless*
16:30-17:00	*Coffee break*
17:00-18:00	*Exercises* *Conor Brennan – Dublin City University*

Thursday 29/9

8:30-10:30	**Speed up techniques for RT prediction**: database reduction and simplification, code parallelization and GPU exploitation, real time RT *Vittorio Degli Esposti – Polaris Wireless*
10:30-11:00	Coffee break
11:00-13:00	**Mm-wave and Terahertz propagation I***: wireless Communication Systems at 60 GHz and beyond, Propagation Conditions and Channel Models at 60 GHz *Thomas Kürner - Technische Universität Braunschweig*
13:00-14:00	Lunch break
14:00-16:30	**Mm-wave and Terahertz propagation II***: wireless Communication Systems at 60 GHz and beyond, Propagation Conditions and Channel Models at 300 GHz *Thomas Kürner - Technische Universität Braunschweig*
16:30-17:00	Coffee break
17:00-18:00	Exercises *Conor Brennan – Dublin City University*

Friday 30/9

8:30-10:30	**Mm-wave and Terahertz propagation III:** stochastic channel model for THz frequencies *Thomas Kürner - Technische Universität Braunschweig*
10-30-11:00	Coffee break
11:00-12:30	**Mm-wave and Terahertz propagation IV:** stochastic channel model for THz frequencies, impact of antenna misalignment in THz Channels, future tasks and challenges *Thomas Kürner - Technische Universität Braunschweig*
12:30-13:30	Lunch break
13:30-15:00	Final exam
15:30-16:00	Wrap-up and distribution of certificates

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September 26-30, 2016
University of Bologna – Cesena Campus, Italy

APPLICATION&PAYMENT FORM

Please send a fax (+39 051 846951) or an electronic copy of this filled form to:
franco.fuschini@unibo.it AND esoa2016@fgm.it

Personal Information:

Name (first / last)			
Address			
Postal code		E-mail	
City		Fax	
Country		Tel.	

Institution/Company:

Name			
Address			
Postal code		E-mail	
City		Fax	
Country		Tel.	
VAT number (if applicable)			

Registration Fees, VAT included: (*please tick the appropriate line*)

Ph.D. Student or University Employee	€ 440,00
Industry or Profit Institutions Employee	€ 880,00

The fee includes tuition, course material, coffee breaks and a social event.

Payment:

(it can be done by cash or by bank transfer - *please tick the preferred payment method*)

	Cash Payment (to be made on the site on September 26, 2016)
	Bank Transfer Payment (to be performed **by September 16, 2016**)
Account name	Fondazione Guglielmo Marconi
Bank name	Banca Popolare Dell'Emilia Romagna – ag. Borgonuovo-S.M.
IBAN code	IT87I0538737100000001447154
BIC/SWIFT code	BPMOIT22 XXX
Object	"Name and Surname" – EsoA Course "Short Range Radio Propagation"

Very important: your name must be indicated in the object when you make the payment.

After the bank transfer, please send a fax (+39 051 846951) or an electronic-scanned copy with the receipt, to: esoa2016@fgm.it

Comments:

Date   **Signature**