



ESoA-IRACON COURSE ON

# LARGE-SCALE RADIO PROPAGATION



The course on *Large Scale Radio Propagation* will be held at the Institute of Information and Communication Technologies, Electronics and Applied Mathematics (ICTEAM), Université catholique de Louvain in the framework of the European School of Antennas 2017 and COST CA15104 IRACON. The course will cover propagation aspects for cellular and vehicular communication. Starting with the basics of propagation, modern methods used in cellular network planning as well as aspects relevant for future 5G networks, e. g. MIMO, multi-link aspects, localisation, car2X and railway communication, are taught. The course includes also computer-based exercises. The teachers are from University of Bologna, Technische Universität Braunschweig, Karlsruhe Institute of Technology, Dublin City University and Université catholique de Louvain.

**Course fees :** University Student (full time Master or Ph. D. student) : 440 €  
Any other participant 880 €

**Location :** ICTEAM UCLouvain, Electrical Engineering (ELEN)  
**Room Shannon, Maxwell building 1<sup>st</sup> floor, 3 place du Levant, Louvain-la-Neuve, Belgium, <https://uclouvain.be/fr/node/1756>** (go to "How to reach our offices" → by train: you will find a walking map, Maxwell Building is building #3)

**Contact :** Prof. Claude Oestges, [claudio.oestges@uclouvain.be](mailto:claudio.oestges@uclouvain.be)  
+32-471-748 763

## Course Schedule

### Monday June 12, 2017

9.00 – 10.00 h	<i>Welcome, Introduction, Overview, Mobile and Wireless Communication Systems</i> Prof. Claude Oestges, Université catholique de Louvain
10.00 – 10.30 h	<i>General Theory of Propagation: Physical Aspects Part I (Path loss, Spreading factor, Fading)</i> Prof. Vittorio Degli-Esposti, University of Bologna
10.30 – 11.00 h	Coffee Break
11.00 - 12.30h	<i>General Theory of Propagation: Physical Aspects Part II (Reflection, Diffraction, Scattering, Multipaths)</i> Prof. Vittorio Degli-Esposti, University of Bologna
12.30 – 13.30 h	Lunch Break
13.30 – 15.00 h	<i>Stochastic and Multidimensional Aspects Part I (Rayleigh and Rice Fading, Channel Transfer Functions)</i> Prof. Vittorio Degli-Esposti, University of Bologna
15.00 – 15.30 h	Coffee Break
15.30 – 17.00 h	<i>Stochastic and Multidimensional Aspects Part II (Spreading in Time, Angles, Selectivity in Frequency, Space, Multidimensional Parameters)</i> Prof. Vittorio Degli-Esposti, University of Bologna
17.00 - 18.00 h	<i>Exercises</i> Prof. Conor Brennan, Dublin City University

### Tuesday June 13, 2017

9.00 – 10.00 h	<i>GIS Data for Radio network Planning Part I</i> Prof. Thomas Kürner, Technische Universität Braunschweig
10.00 – 10.30 h	Coffee Break
10.30 - 12.30h	<i>GIS Data for Radio network Planning Part II</i> Prof. Thomas Kürner, Technische Universität Braunschweig
12.30 – 13.30 h	Lunch Break
13.30 – 15.00 h	<i>Localisation</i> Prof. Vittorio Degli-Esposti, University of Bologna
15.00 – 15.30 h	Coffee Break
15.30 – 17.30 h	<i>Path Loss Modeling for Cellular Networks</i> Prof. Thomas Kürner, Technische Universität Braunschweig
17.30 - 18.30 h	<i>Exercises</i> Prof. Conor Brennan, Dublin City University

**Wednesday June 14, 2017**

9.00 – 10.30 h	<i>Coverage Planning and Planning Tools</i> Prof. Thomas Kürner, Technische Universität Braunschweig
10.30 – 11.00 h	Coffee Break
11.00 - 13.00h	<i>Propagation Modeling for High-Speed Railways</i> Prof. Thomas Kürner, Technische Universität Braunschweig
13.00 – 14.00 h	Lunch Break
14.00 – 15.30 h	<i>Propagation and Channel Modeling for Car2X Communication, Part I</i> Prof. Werner Wiesbeck, Karlsruhe Institute of Technology
15.30 – 16.00 h	Coffee Break
16.00 – 17.30 h	<i>Propagation and Channel Modeling for Car2X Communication, Part II</i> Prof. Werner Wiesbeck, Karlsruhe Institute of Technology
17.30 - 18.30 h	<i>Exercises</i> Prof. Conor Brennan, Dublin City University
19.00	<i>Dinner</i>

**Thursday June 15, 2017**

9.00 – 10.30 h	<i>Deterministic and semi-empirical channel models for urban areas Part I</i> Prof. Conor Brennan, Dublin City University
10.30 – 11.00 h	Coffee Break
11.00 - 12.00h	<i>Deterministic and semi-empirical channel models for urban areas Part II</i> Prof. Conor Brennan, Dublin City University
12.00 – 13.00 h	Lunch Break
13.00 – 14.30 h	<i>Advanced electromagnetic models</i> Prof. Conor Brennan, Dublin City University
14.30 – 15.00 h	Coffee Break
15.00 – 17.00 h	<i>MIMO Channels: steering vectors, eigenvalues, MIMO models, beamforming, massive MIMO, etc.</i> Prof. Claude Oestges, Université catholique de Louvain
17.00 - 18.00 h	<i>Exercises</i> Prof. Conor Brennan, Dublin City University

**Friday June 16, 2017**

9.00 – 10.30 h	<i>4G to 5G Channel Models Part I</i> Prof. Claude Oestges, Université catholique de Louvain
10.30 – 11.00 h	Coffee Break
11.00 - 12.30 h	<i>4G to 5G Channel Models Part II</i> Prof. Claude Oestges, Université catholique de Louvain
12.30 – 13.30 h	<i>Final exam</i>
13.30 – 14.30h	Lunch Break
14.30 – 15.00h	<i>Wrap-up and distribution of certificates</i>

## **Accommodation**

In view of the course, a number of rooms have been pre-booked at the University Hostel (some with shared bathrooms), at the rate of 34 EUR/night.

Other options (book as early as possible, as places are very scarce):

- in Louvain-la-Neuve (20 min walk to ICTEAM): Ibis Style Louvain-la-Neuve, book directly on the hotel website : <http://www.ibis.com/gb/hotel-2200-ibis-styles-meeting-center-louvain-la-neuve/index.shtml>
- in Wavre (you need to take a bus from Wavre to Louvain-la-Neuve, the travel is about 20 minutes) : Ibis Wavre, book directly on the hotel website : <http://www.ibis.com/gb/hotel-9958-ibis-wavre/index.shtml>
- in Wavre (you need a car or use a taxi): Hotel Leonardo Wavre (special UCL rates) <http://www.leonardo-hotels.com/leonardo-hotel-wavre>

If you wish to book one room at the **University Hostel** or at the **Leonardo Hotel** at UCL rates, please send your reservation request to Mrs. Marie-Christine Vandingenen, [marie-christine.vandingenen@uclouvain.be](mailto:marie-christine.vandingenen@uclouvain.be) as soon as possible, but before May 10, 2017.