



UNIVERSITÀ DI PISA  
**DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE**  
**Dottorato di Ricerca in Ingegneria dell'Informazione**

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Doctoral Course

**“OpenAir 5G Lab”**

Prof. Florian Kaltenberger

*Mobile Communications Department, EURECOM  
France*

**Short Abstract:** In this short course students will get an introduction into the OpenAirInterface project, an open-source software defined radio implementation of 3GPP standards that allows users to setup a 3GPP LTE network (and soon a 5G network) using only off-the-shelf computing and software defined radio hardware. The course will also include some basics about LTE and 5G. Students will get hands-on experience in the lab sessions where they will learn how to setup an LTE network with the USRP B210 to establish a connection to a real phone. Further we will also setup an experiment with USRP N310 that will demonstrate some basic 5G NR functionalities. Each lab sessions will have some tasks defined that the students will have to solve in groups of 2-3.

Students should have a basic experience of wireless communications and software development under Linux. Some prior knowledge of 4G and 5G technologies are beneficial.

**Course Contents in brief:**

- Lecture 1: Introduction to OpenAirInterface
- Lab session 1: setting up a network
- Lecture 2: LTE physical layer
- Lab session 2: understanding and using the LTE unitary simulators
- Lecture 3: LTE Higher layers and procedures
- Lab session 3: Analyze the connection procedure and extract the RRC messages
- Lecture 4: 5G-NR: Architecture and Physical layer
- Lab session 4: 5G-NR unitary simulators and state of development

**Total # of hours of lecture:** 20 hours

**References:**

[1] [www.openairinterface.org](http://www.openairinterface.org)

### **CV of the Teacher**

Florian Kaltenberger is an Assistant Professor in the Communication Systems department at EURECOM (France). He received his Diploma degree (Dipl.-Ing.) and his PhD both in Technical Mathematics from the Vienna University of Technology 2002 and 2007 respectively. He is part of the development team for the real-time open-source 5G platform OpenAirInterface.org and manages several research projects (industrial and academic) around the platform. He also teaches a course on radio engineering. His research interests include 5G and MIMO systems at large, software defined radio, signal processing for wireless communications, as well as channel modeling and simulation. In 2013, he received the Neal Shepherd Best propagation Award for the Journal article "Experimental characterization and modeling of outdoor-to-indoor and indoor-to-indoor distributed channels" (IEEE Transactions on Vehicular Technology, June 2010). In 2016, he received the best demo award for the project ADEL at the European Conference on Networks and Communications.

### **Room and Schedule**

Room: *Aula Riunioni del Dipartimento di Ingegneria dell'Informazione, Via G. Caruso 16, Pisa – Ground Floor*

Schedule: Monday, 30 Sept. – Thursday, 3rd Oct, 2019

Monday, 30 Sept.	14:00-17:00	
Tuesday, 1 Oct.	9:00-12:00	14:00-17:00
Wednesday, 2 Oct.	9:00-12:00	14:00-17:00
Thursday, 3 Oct.	9:00-12:00	14:00-16:00