Doctoral Course

„Design Concepts of Radio Frequency (RF) and Microwave Circuits for Wireless Applications“
16hrs

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Short Abstract: This lecture is dedicated to the introduction of design methods for RF and microwave circuits for wireless applications. It introduces the concepts of transmission line and its application as distributed electronics. Matching techniques together with Smith chart as well as "S" matrix will be introduced and illustrated on worked examples. Then passive devices, such as resonators, couplers, and filters will be studied and developed on several examples. It follows active circuits such Low Noise Amplifiers and Power Amplifiers. Noise figure and Nonlinear parameters will be introduced. Frequency up-converter and down-converter will be described too. Then, integrated antenna constraints will be discussed. Finally link budget and noise figure of a wireless system will be discussed.

Course Contents and Schedule:

- Introduction 1hrs.
  - Emergence of RF Wireless systems
  - Electromagnetic spectrum and RF regulations
  - Distributed versus lumped electronics

- Transmission Line Theory 2hrs.
  - Concept of transmission lines
  - RLCG Model
  - Planar transmission lines : Microstrip

- Tools for RF circuits 3hrs.
  - Smith diagram and matching techniques
  - S Matrix
  - Measurements of RF circuits

- Passive Devices 3hrs.
  - Power dividers
  - Coupler
  - Filters

- Active circuits 2hrs
    - Model of Transistor
    - Low Noise Amplifier
    - Stability of LNA
    - Gain definition

- Noise Figure and Non-Linear Parameters 2hrs.
    - Noise Figure
    - Design for Constant Noise Figures

- Lab : VNA demonstration 2hr

- Conclusions and Future Issues 1hr.

References:

- "Microwave Engineering" , David Pozar, Editor Wiley
- "RF and Microwave Wireless Systems". Kai Chang, Editor Wiley
- http://www.avagotech.com/appcad
- Amanogawa.com Interactive Software for Education http://www.amanogawa.com/
- TX-LINE: Transmission Line Calculator | NI AWR Design Environment
- http://www.awrcorp.com/products/optional-products/tx-line-transmission-

CV of the teacher: Smail TEDJINI, Doctor Physics Grenoble University 1985. 1981-1986 Assistant Professor at Grenoble Institute of Technology, Senior Researcher of CNRS (Research French National Center) 1986 to 1993. He became University Full Professor 1993. Since 1996 he is Professor at esisar: Dpt. of Grenoble-inp. His main teaching topics concern Electromagnetism, RadioFrequency, Wireless Systems and Optoelectronics. He served as coordinator/member in numerous academic programs both for education and research. He was coordinator for Ph.D., Master and Bachelor programs for Grenoble University. Some programs are under international collaboration with universities from Europe, USA, Canada, Brazil, Vietnam, Egypt, Maghreb. He founded the LCIS lab and served as its Director. He also served as the Director of esisar. He has more than 30 year experience in Education, Research and Management of university affairs. Now, he is project manager within ORSYS group that he leaded until 2014 and founded 15 years ago. He supervised more than 35 PhDs, has more than 300 publications and patents. He organized several conferences/workshops. Senior Member IEEE, Past-President and founder of the IEEE-CPMT French Chapter, Vice-President of IEEE Section France and elected as the Vice-Chair of URSI Commission D "Electronics & Photonics" in 2008. He was reelected as vice-chair of IEEE-France-section and served as the Chair of URSI Commission "D" for the triennium 2011-2014. In 2015 he was elected President of URSI-France**.**