

Tutorial Proposal

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Title: Adaptive Techniques in Wireless Networks: Theory and Practice

Duration: Half day.

Target audience: Graduate students, engineers working in the wireless industry, professors and researchers. Pre-requisite knowledge: general area of digital communications. There is no need for specific knowledge in adaptive processing.

Summary:

Adaptation in wireless networks is very important as it allows wireless communication systems to adapt to the channel and network time-varying conditions. Adaptation can be made at the receiver (e.g., adaptive equalization), at the transmitter (e.g., adaptive modulation and coding), and more generally, at the different layers of the network protocol stack (e.g., adaptive radio resource management and adaptive networking).

This tutorial emphasizes on adaptive signal processing as well as cross-layer adaptation approaches and their impact on current and future wireless communications. The tutorial will illustrate the concept of adaptation through theoretical, simulation and applied results targeting key areas such as MIMO and OFDM systems, WiMAX, Mesh networks, sensor and ad hoc networks, as well as heterogeneous networks. A real-time demonstration will be presented on energy and network life-time optimization in wireless sensor networks.

Outline:

- 1- Introduction: The need for adaptation in wireless networks.
- 2- Adaptation at the physical layer:
 - a. Adaptive channel identification.
 - b. Adaptive modulation and coding.
 - c. Adaptive equalization.
 - d. Adaptive diversity and cooperative processing.
 - e. Adaptive MIMO transmission.
 - f. Adaptive OFDM and WiMAX.
- 3- Adaptive medium access control and cross-layer adaptation.
- 4- Adaptive routing in wireless sensor and ad hoc networks.
- 5- Adaptation in heterogeneous networks.
- 6- Implementation and reconfigurable devices (insights into cognitive radio).
- 7- Demonstration: Energy and network life-time optimization in a wireless sensor network used for real-time tracking.
- 8- Conclusion: The future of adaptation in wireless networks.

Material to be distributed to the attendees:

- Power Point presentation.
- 3 key papers in the topic.
- Technical information about the demonstration.

Short Biography of the instructor:

Dr. Mohamed Ibnkahla obtained the Ph.D. degree and the 'Habilitation a Diriger des Recherches degree' (HDR) from the National Polytechnic Institute of Toulouse (INP), Toulouse, France, in 1996 and 1998, respectively.

Dr. Ibnkahla is currently an Associate Professor at the Department of Electrical and Computer Engineering, Queen's University, Kingston, Canada. He has been previously an Assistant Professor at INP (1996-1999) and Queen's University (2000-2004).

Dr. Ibnkahla has been leading several projects with industry and government agencies including the European ACTS program (1996-1999), the Canadian CITR program (2001-2003), Ontario Centers of Excellence (2003-2005 and 2007-2010). His area of research focuses mainly on adaptive signal processing and wireless communications.

He has published '*Signal Processing for Mobile Communications Handbook*', CRC Press, 2004 (800 pages), '*Adaptive Signal Processing in Wireless Communications*', CRC Press, 2008 (500 pages), and '*Adaptive Networking and Cross-layer Design in Wireless Networks*', CRC Press, 2008 (500 pages).

He has published more than 35 peer-reviewed journal papers and book chapters, 20 technical reports, and 70 conference papers. These publications include a significant number of invited papers. He has supervised 5 post doctoral fellows and more than 40 graduate students.

Dr. Ibnkahla received the *INP Leopold Escande Medal* for the year 1997, France, for *his research contributions to signal processing*; the prestigious *Prime Minister's Research Excellence Award (PREA)*, Ontario, Canada in 2000, for *his contributions in wireless mobile communications*; and the *Favorite Professor Award*, Queen's University, in 2004 for *his excellence in teaching*.

Dr. Ibnkahla has given several tutorials in related topics at various conferences and summer schools, such as ISSPA'03 (Paris, France, July 2003), GLOBECOM'07 (Washington, DC, November 2007), and ICASSP'08 (Las Vegas, USA, April 2008).