

Concordia University, the IEEE Montreal Section and the Chapter of Communications Society (ComSoc), are inviting all interested IEEE Montreal Communications & IT Chapter members and other engineers, technologists, and students to a technical seminar on:

Topic: Shaping the Future of Wireless: Two-way connectivity, Media-based Communications and Unconditional Security"

By

Dr. Amir Kayvan Khandani

Professor at Electrical and Computer Engineering Dept., Univ. of Waterloo, Ontario, Canada
Research in Motion (RIM) - NSERC Industrial Research Chair and Canada Research Chair

DATE: Tuesday September 04th, 2012.

TIME: 10:00 AM

PLACE: Concordia University, 1515 Ste. Catherine West, Elect. & Comp. Engineering Department,
Room EV003.309

ADMISSION: Free. For more information, please an e-mail contacting: Dr. Reza M. Soleymani
msoleyma@ece.concordia.ca or Dr. Anader Benyamin-Seeyar at anader.benyamin@ieee.org.

More Info: <http://ewh.ieee.org/r7/montreal>.

Abstract

Current wireless systems are one-way (similar to walkie-talkies), meaning that disjoint time or frequency segments are used to transmit and to receive. Realization of two-way wireless has challenged the research community for many years, generally believed to be impossible. This talk introduces a new theoretical framework for two-way wireless, and presents its hardware realization (over-the-air transmission in the ISM band). In contrast to the widely accepted belief, it is established that two-way wireless is not only possible, but is fairly simple, with virtually no degradation in signal-to-noise-ratio. Methods are developed to support multiple antenna (MIMO) two-way transmission, and asynchronous two-way links (useful in networking applications). More importantly, it is shown that, due to the broadcast nature of wireless transmission, two-way wireless can do much more than just doubling the rate. A number of new applications are introduced, showing that two-way wireless:

1. Significantly facilitates wireless networking.
2. Provides the ground to realize unbreakable security (beyond computational or information theoretical security) by exploiting linearity and randomness of RF channel.
3. Enhances Information Theoretical, as well as computational security through "intelligent jamming".
4. Enables a new method of wireless communications (to be introduced in this talk) based on embedding data in the transmission media by changing its RF properties in contrast to embedding data in the transmitted signal, and thereby significantly exceeding many of the known theoretical limits on wireless channel capacity.
5. Enables practical realization of multi-node distributed & collaborative networking, which has been the topic of extensive research in the context of Network Information Theory, but is still far from practice.
6. Doubles the point-to-point throughput.

The innovation is in the antenna design and multiple levels for canceling self-interference. The developed hardware uses off-the-shelf components, antennas are omnidirectional, do not suffer from bandwidth limitations, have a small size/spacing (comparable to current one-way systems), and the increase in signal processing complexity vs. one-way is virtually zero. These findings are expected to have a profound impact on wireless transmission, networking and security in the near future, more significant than other breakthroughs in the area reported in the last few decades.

Dr. Amir K. Khandani - Short Bio

Dr. Khandani is a professor of electrical and computer engineering at the University of Waterloo. He received his B.Sc/M.Sc. degree from Tehran University, Iran, and Ph.D. degree from McGill University, Canada, in 1984 and 1992, respectively. He joined the University of Waterloo in 1993. He currently holds the RIM-NSERC Industrial Research Chair on Network Information Theory and a Canada Research Chair on Wireless Systems. Prior to the RIM-NSERC Chair, he held an NSERC Industrial Research Chair funded by Nortel. He has supervised more than 40 PhD students, 30 master's students, 30 post-doctoral fellows and 10 research engineers. His former team members have successful careers in industry and academia across the globe.