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# THE CHINESE UNIVERSITY OF HONG KONG

Department of Information Engineering

*Seminar*

## Cutting the Last Wires by Wireless Power Transfer and Energy Harvesting

**by**

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**Date : 12 March, 2013 (Tue.)**
**Time : 11:00am-12:00noon**
**Venue : Room 833 Ho Sin Hang Engineering Building**
**The Chinese University of Hong Kong**

*Abstract*

Despite the explosive growth of wireless communications, mobile devices still have to be connected by cables to the electric grid periodically for recharging and cutting these "last wires" is the theme of this talk. The interruption of mobile services due to dead batteries can cause not only user inconvenience but also severe issues such as financial loss and health threats. The urgency of addressing this issue and the existence of huge market potential have recently motivated active research on wireless power transfer (WPT) and energy harvesting. WPT using dedicated power sources can deliver sufficient power for operating large mobiles such as small airplanes. To power lower-complexity mobiles such as sensors, it may be sufficient to simply harvest energy from the ambient environment such as RF radiation and solar power. In this talk, I will share my recent research on applying stochastic-geometry to design and analyze mobile networks powered using these new technologies.

In the first part, I will propose a novel network architecture that overlays a cellular network with randomly deployed fixed station call power beacons (PBs), which wirelessly charge mobiles by microwave power transfer (MPT). Efficient MPT based on this architecture will be feasible for future mobile networks via combining small-cells and massive antennas and the dense deployment of low-complexity PBs. Based on a stochastic-geometry network model, I will show the fundamental tradeoffs between the base-station density and PB density under a constraint on the data-link reliability.

In the second part, I will consider a mobile ad hoc network powered by energy harvesting. In this research, the network is modeled using a Poisson point process and random energy arrivals at transmitters are modeled as stochastic processes. Based on this model, the relation between the dynamics of harvested energy and the active transmitter density is established and applied to derive the maximum network spatial throughput for a given energy arrival rate.

*Biography*

Kaibin Huang received the B.Eng. (first-class hons.) and the M.Eng. from the National University of Singapore in 1998 and 2000, respectively, and the Ph.D. degree from The University of Texas at Austin (UT Austin) in 2008, all in electrical engineering.

Since Jul. 2012, he has been an assistant professor in the Dept. of Applied Mathematics at The Hong Kong Polytechnic University, Hong Kong. He had held the same position in the School of Electrical and Electronic Engineering at Yonsei University, S. Korea from Mar. 2009 to Jun. 2012 and presently is affiliated with the school as an adjunct professor. From Jun. 2008 to Feb. 2009, he was a Postdoctoral Research Fellow in the Department of Electrical and Computer Engineering at the Hong Kong University of Science and Technology. From Nov. 1999 to Jul. 2004, he was an Associate Scientist at the Institute for Infocomm Research in Singapore. He frequently serves on the technical program committees of major IEEE conferences in wireless communications. He will chair the Comm. Theory Symp. of IEEE ICC 2014 and has been the technical co-chair for IEEE CTW 2013, the track chair for IEEE Asilomar 2011, and the track co-chair for IEE VTC Spring 2013 and IEEE WCNC 2011. He is an editor for the IEEE Wireless Communications Letters and also the Journal of Communication and Networks. He is an elected member of the SPCOM Technical Committee of the IEEE Signal Processing Society. Dr. Huang received the Outstanding Teaching Award from Yonsei, Motorola Partnerships in Research Grant, the University Continuing Fellowship at UT Austin, and a Best Paper award at IEEE GLOBECOM 2006. His research interests focus on the analysis and design of wireless networks using stochastic geometry and multi-antenna limited feedback techniques.

**** ALL ARE WELCOME ****

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