The University of New South Wales

Faculty of Engineering

School of Electrical Engineering & Telecommunications

Invited Talk

Smart Energy Management in Wireless Networks with Harvested Energy

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Time: 10:40 a.m. – 11:30 a.m.
Venue: G3, Electrical Engineering Building

Abstract

With the ever-growing traffic demands, the increase of the energy consumption in wireless networks has become a key concern. Utilizing the renewable energy by energy harvesting technologies is an effective way to deal with the global energy crisis. However, as the harvested energy is highly unstable in nature, it has to be managed in a smart way in order not to cause too much performance degradation when the harvested energy is not enough while not wasting the harvested energy too much when it is more than enough. In this talk, we firstly consider a single wireless node with SISO or MIMO links powered by both power grid and renewable energy (hybrid power supply) and propose a two-stage water-filling energy management algorithm, which is proven to be optimal for throughput maximization and grid power minimization. Then, we extend the work to a cellular network where multiple base stations (BSs) with hybrid power supply and propose a low-complexity dynamic programming-based BS sleeping and resource allocation algorithm. Finally, we take the harvested energy transfer among different BSs and the limited battery capacity into account and propose a joint data scheduling and energy management policy to maximize the network utility. Based on Lyapunov optimization theorem, it is shown that our proposed policy can approach to the optimal network utility as close as possible.

Speaker Biography

Zhisheng Niu graduated from Beijing Jiaotong University, China, in 1985, and got his M.E. and D.E. degrees from Toyohashi University of Technology, Japan, in 1989 and 1992, respectively. In 1992-94 he worked for Fujitsu Laboratories Ltd., Kawasaki, Japan, and joined with Tsinghua University, Beijing, China, in 1994, where he is now a professor at the Department of Electronic Engineering. He is also a guest chair professor of Shandong University, China. His major research interests include queuing theory, traffic engineering, mobile Internet, radio resource management of wireless networks, and green communication and networks.

Dr. Niu has been an active volunteer for various academic societies, including Director for Conference Publications (2010-11), Director for Asia-Pacific Board (2008-09), and member of the Award Committee of IEEE Communication Society, Membership Development Coordinator (2009-10) of IEEE Region 10, Councilor of IEICE-Japan (2009-11), council member of Chinese Institute of Electronics (2006-11), and an editor of IEEE Wireless Communication Magazine (2009-2013). He is now a distinguished lecturer (2012-15) and Chair of Emerging Technology Committee (2014-15) of IEEE Communication Society, member of the Fellow Nomination Committee of IEICE Communication Society (2013-14), standing committee member of Chinese Institute of Communications (2012-16), and associate editor-in-chief of IEEE/CIC joint publication “China Communications”.

Dr. Niu received the Outstanding Young Researcher Award from Natural Science Foundation of China in 2009 and the Best Paper Award of IEEE ComSoc Asia-Pacific Region in 2013. He also co-received the Best Paper Awards (with his colleagues) from the 13th, 15th and 19th Asia-Pacific Conference on Communication (APCC) in 2007, 2009, and 2013, respectively, International Conference on Wireless Communications and Signal Processing (WCSP’13), and the Best Student Paper Award (with his student) from the 25th International Teletraffic Congress (ITC25), 2013. He is now the Chief Scientist of the National Basic Research Program (so called “973 Project”) of China on "Fundamental Research on the Energy and Resource Optimized Hyper-Cellular Mobile Communication System" (2012-2016), which is the first national project on green communications in China. He is a fellow of both IEEE and IEICE