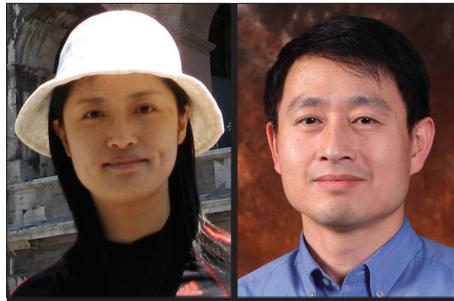# NEW R&D TOOLS FOR WIRELESS COMMUNICATIONS

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Wireless communication comes in many varieties, from first to fourth generation (1G to 4G), from WiFi to WiMAX, and from Bluetooth to satellite phones. Researchers in both academia and industry are continuously being challenged by market demands for more varieties of high-quality services. In recent years, there have been many attempts to solve problems in wireless communications using methods typically belonging to other fields. For example, game theory is now widely used in designing distributed resource allocation schemes. Other examples include analytical tools in operations research, computer science, and physics. This feature topic aims at providing a state-of-the-art overview of some new R&D tools.

The first article, by Berry, Honig, and Vohra, examines a market approach to spectrum management. It is widely accepted that due to inappropriate regulations, a large part of the radio spectrum is not being efficiently used. Allowing spectrum to be traded and rented across location and time would provide incentives for the dynamic sharing of spectrum. It is hoped that radio regulation agencies across the world would respond to this suggestion.

The second article, by Andrews, Ganti, Haenggi, Jindal, and Weber, gives a tutorial on spatial modeling and analysis in wireless networks. Six common spatial models are compared based on their key properties and application areas. These tools are commonly called stochastic geometry, and they are indispensible for the analytic study of wireless networks. This article is particularly useful to the research community.

The third article, by Berger, Wang, Huang, and Zhou, is a tutorial on compressed sensing and its application to channel estimation. Compressed sensing is a recently coined term for a very useful mathematical method with wide applications in imaging, data compression, radar, and data acquisition. The method introduced may be a bit complicated, but readers would appreciate that its application to communication technology is not limited to channel estimation.

Finally, the last article, by Dressler and Akan, is on bio-inspired analytical methods. Three examples are given: ant colony optimization, artificial immune system, and cellular signaling cascade. Human society is a vastly complex network. Social etiquette, moral principles, and legal systems evolved throughout the ages in different civilizations are rich sources for network research tools. We hope that this article can inspire readers to think deeper in this direction.

BIOGRAPHIES

YING JUN [M] (ANGELA) ZHANG (yjzhang@ie.cuhk.edu.hk) received her Ph.D. degree in electrical and electronic engineering from the Hong Kong University of Science and Technology in 2004. Since January 2005 she has been with the Department of Information Engineering iat the Chinese University of Hong Kong, where she is currently an assistant professor. Her research interests include wireless communications and mobile networks, adaptive resource allocation, optimization in wireless networks, wireless LAN/MAN, broadband OFDM and multicarrier techniques, and MIMO signal processing. She is on the Editorial Boards of *IEEE Transactions on Wireless Communications* and *Wiley Security and Communications Networks Journal*. She served as TPC Co-Chair of the Communication Theory Symposium of IEEE ICC 2009, Track Chair of ICCCN 2007, and Publicity Chair of IEEE MASS 2007. She has served as a Technical Program Committee member for leading conferences including IEEE ICC, IEEE GLOBECOM, IEEE WCNC, IEEE ICC-CAS, IWCMC, IEEE CCNC, IEEE ITW, IEEE MASS, MSN, and ChinaCom. She is an IEEE Technical Activity Board GOLD Representative, 2008 IEEE GOLD Technical Conference Program Leader, IEEE Communication Society GOLD Coordinator, and a member of the IEEE Communication Society Member Relations Council (MRC). As the only winner from engineering science, she won the Hong Kong Young Scientist Award 2006, conferred by the Hong Kong Institution of Science.

PETER YUM (tsyum@ie.cuhk.edu.hk) received primary and secondary school education in Hong Kong. He went to Columbia University and was awarded B.S., M.S., M.Ph. and Ph.D. degrees in 1974, 1975, 1977, and 1978, respectively. He joined Bell Telephone Laboratories in April 1978 working on switching and signaling systems for two and a half years. Then he taught at National Chiao Tung University, Taiwan for two years before joining the Chinese University of Hong Kong in 1982. He is now on leave from the Chinese University of Hong Kong to serve as CTO of the Hong Kong Applied Science and Technology Research Institute (http://www.astri.org). He has published widely in Internet research with contributions to routing, buffer management, deadlock handling, message resequencing, and multi-access protocols. He then branched out to work on cellular networks, lightwave networks, video distribution networks, and 3G networks. His recent research is in the areas of RFID, sensor networks, and wireless positioning technologies. His diverse industrial experience includes Bell Labs, Bellcore (now Telcordia), IBM Research, Motorola Semiconductors and ITRI of Taiwan, SmarTone Communications, and Radio-Television (Hong Kong) Ltd. He has also lectured extensively in major universities in China and was appointed adjunct professor at South East University, Zhejiang University, and Huazhong University of Science and Technology. In 2008 he accepted a chaired professorship appointment at Tsinghua University. He was appointed the Fulbright Hong Kong Distinguished Scholar (2005–2006) for lecturing in U.S. universities for three weeks. In 2008 he was awarded the Distinguished Visiting Fellowship from the Royal Academy of Engineering, United Kingdom, for a three-week lecturing tour of U.K. universities. Recently, he and student Lei Zhu were awarded the Best Paper Award of ACM MSWiM 2009 for "The Optimization of Framed Aloha Based RFID Algorithms."