Dallas Chapter of IEEE Signal Processing Society & Electrical Engineering Seminar Series Present

Minimum Energy Communications in Interference Networks

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A simple fundamental question in wireless networking: what is the energy needed to transmit one bit of information over a wireless network? The impetus for this question is clearly conservation of battery power in mobile devices, but also energy conservation per se. While at first one could think that reducing energy consumption in wireless devices can only contribute marginally to energy conservation, a closer examination shows that this is not true. Currently it is estimated that consumer electronics account for 11% of total residential electricity consumption in the US. Wireless communications could account for a significant part of this energy consumption. Clearly, if this energy consumption can be reduced just 3dB, the energy saving is significant. For many networks, the minimum energy is achieved in the low power regime, i.e., for the bandwidth approaching infinity. In this talk we will discuss the low power behavior of interference and broadcast networks. The first issue we will examine is how correlation between sources can be used to reduce energy. We will find the exact minimum energy for a number of networks. The second issue we will examine is the wideband slope of interference networks. The wideband slope quantifies the behavior in the low power regime, when the bandwidth is large, but not infinite. We will show that the wideband slope is at most cut in half, independently of the number of users. That is, the performance of a K-user system is no worse than that of a 2-user system.

Anders Høst-Madsen received the Ph.D. degree in mathematics in 1993 from the Technical University of Denmark. From 1993 to 1996 he was with Dantec Measurement Technology A/S, Copenhagen, Denmark, from 1996 to 1998 he was an assistant professor at Kwangju Institute of Science and Technology, Kwangju, Korea, and from 1998 to 2000 an assistant professor at Department of Electrical and Computer Engineering, University of Calgary, Calgary, AB, Canada, and a staff scientist at TRLabs, Calgary. Since 2001 he has been with the Department of Electrical Engineering, University of Hawaii at Manoa, Honolulu, since 2009 as professor. He was also a founder and CTO (2007-2008) of Kai Medical, Inc., which is making equipment for non-contact heart monitoring. His research interests are in statistical signal processing, information theory, and wireless communications, including ad-hoc networks, cooperative diversity, wireless sensor networks, heart monitoring, life detection, and marine mammal signal processing. He has served as Editor for Multiuser Communications for the IEEE Transactions on Communications and as Associate Editor for Detection and Estimation for the IEEE Transactions on Information Theory. He is general co-chair of ISITA 2012 and IEEE ISIT 2014. He received the Eurasip Journal of Wireless Communications and Networks (JWCN) best paper award in 2006.

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