Title

Hybrid Beamforming Design for Millimeter-Wave Multi-Carrier Systems

Lecturer

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Abstract

Owing to the strong demand on high-speed wireless communications, millimeter wave (mmWave) communications have emerged as one of the most promising technologies. Due to the short wavelength of mmWave channels, mmWave devices can be equipped with multiple antennas and employ beamforming to alleviate the path loss problem. The full-digital beamforming technique usually used in sub-6 GHz systems is impractical for mmWave systems as the massive RF chains needed introduce great power consumption. Hybrid beamforming has been proposed as an attractive alternative for its limited number of RF chains and comparable performance to full-digital beamforming.

In this talk, we introduce a new hybrid beamforming design for multiple-input multiple-output (MIMO) orthogonal frequency-division multiplexing (OFDM) systems over indoor mmWave channels under practical hybrid beamforming constraints for multi-carrier system. We reduce the amount of required channel state information (CSI) by exploring the frequency-domain correlation of indoor mmWave channels. The hybrid beamforming algorithm is then extended to the limited feedback scheme in which the transmit beamformers are designed based on limited information fed back from the receiver. Simulation results demonstrate that our hybrid beamforming design achieves the performance level of traditional full-digital beamforming with low complexity and the limited feedback scheme has better performance and lower complexity than previous algorithms, even if the amount of CSI is greatly reduced.

Speaker Biography

Chi-chao Chao received the B.S. degree from the National Taiwan University, Taipei, Taiwan, in 1983 and the M.S. and Ph.D. degrees from the California Institute of Technology (Caltech), Pasadena, California, USA, in 1986 and 1989, respectively, all

in electrical engineering. Since August 1989, he has been with the National Tsing Hua University (NTHU), Hsinchu, Taiwan, where he is currently a Tsing Hua Distinguished Professor in the Department of Electrical Engineering and the Institute of Communications Engineering. He held visiting positions at Caltech from September 1995 to March 1996, at Bell Communications Research, Morristown, New Jersey, USA, from March 1996 to August 1996, and at Osaka University, Japan, from April 2009 to September 2009. He is currently visiting Doshisha University, Kyoto, Japan.

Dr. Chao was the Secretary of the IEEE Taipei Section from 1997 to 1998, the Chair of the IEEE Information Theory Society Taipei Chapter from 1999 to 2001, and the Chair of the IEEE Communications Society Taipei Chapter from 2009 to 2010. He served as an Associate Editor for the IEEE Communications Letters from 2002 to 2005. He was a General Co-Chair of the 2010 International Symposium on Information Theory and its Applications and the 2010 International Symposium on Spread Spectrum Techniques and Applications held in Taichung, Taiwan, October 2010.

Dr. Chao received the Distinguished Teaching Awards from NTHU in 1993, 2002, 2008 and the Y. Z. Hsu Science Paper Award in 2018. His current research interests include digital communications, error-correcting codes, information theory, and wireless networks.

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