Titre: “Interference management in wireless networks: Practice and Theory”

Abstract:

In this talk, we discuss interference management for wireless networks and look at the problem from two perspectives.
In part one, we take an industry perspective and evaluate the system level performance of interference management techniques relying on multiple antennas and coordination among cells (denoted as CoMP in LTE-A) to assess their benefits and sensitivities to various impairments. We observe how quickly the performance degrades when impairments are taken into account. We introduce some novel and practical type of coordination that is less sensitive to impairments. The performance benefits are shown through extensive system level evaluations compliant with LTE-A.

In part two, we take a more academic perspective and look at how interference could be exploited in wireless networks: first in scenarios where channel state information is imperfectly known at the transmitter and second in scenarios where wireless information and energy are simultaneously transferred. Inspired by LTE-A system, we investigate a frequency correlated Broadcast Channel where a two-antenna transmitter has imperfect knowledge of CSI of two single-antenna users on two adjacent subbands. We derive an optimal degrees-of-freedom (DoF) region for a general setting of imperfect CSIT across the two subbands and the two users and propose a novel transmission strategy that integrates Zero-Forcing Beamforming (ZFBF), MAT (Maddah-Ali and Tse) scheme and Frequency Division Multiple Access (FDMA), to achieve the optimal DoF region. Motivated by the DoF analysis, we investigate the benefits of sub-optimal transmission strategies and feedback allocation policies among users and subbands. The results ultimately provide new insights into how to design multi-user communication systems relying on imperfect CSI feedback for next generation multi-carrier networks. We then move on the joint wireless information and energy transfer in a two-user MIMO interference channel, in which each receiver either decodes the incoming information data (information decoding, ID) or harvests the RF energy (energy harvesting, EH) to operate with a potentially perpetual energy supply. We derive appropriate transmission strategies (beamforming and power control) and identify the achievable rate-energy (RE) tradeoff region. The study eventually sheds light on whether interference is beneficial or detrimental to wireless networks.

Bio:
Bruno Clerckx received his M.S. and Ph.D. degree in applied science from the Université catholique de Louvain (Belgium) in 2000 and 2005, respectively. He held visiting research positions at Stanford University (CA, USA) in 2003 and EURECOM (Sophia-Antipolis, France) in 2004. In 2006, he was a Post-Doc at the Université catholique de Louvain. From 2006 to 2011, he was with Samsung Electronics (Suwon, South Korea) where he actively contributed to 3GPP LTE/LTE-A and IEEE 802.16m and acted as the rapporteur for the 3GPP Coordinated Multi-Point (CoMP) Study Item and the editor of the technical report 3GPP TR36.819. Since September 2011, he has been an Assistant Professor in the Electrical and Electronic Engineering Department at Imperial College London (London, United Kingdom).