

Tutorial T-7: Massive MIMO for 5G: From Theory to Practice

Presenters: Fredrik Tufvesson (Lund University, Sweden), Andre Bourdoux (IMEC, Belgium)

Tutorial Overview

Over the last the couple of years, massive MIMO has gone from being a theoretical concept to becoming one of the most promising ingredients of the emerging 5G technology. This is because it provides a way to improve the area spectral efficiency (bit/s/Hz/area) with 100x under realistic conditions, by upgrading existing base stations. In other words, Massive MIMO is a commercially attractive solution since 100x higher efficiency is possible without installing 100x more base stations (with high costs for site renting, backhaul infrastructure, and network calibration).

This tutorial is linked to tutorial T-2 on Monday morning and covers the following topics:

PART 1 (First 1.5 hours)

Channel characteristics for Massive MIMO, results from channel measurement campaigns, spatial resolution, influence of antenna configuration, compact vs. physically large arrays, channel modelling for Massive MIMO

Implementation aspects, lessons learnt from the implementation of the Lund University Massive MIMO testbed – LuMaMi

Distributed vs. centralized processing

Uplink-downlink reciprocity

Data management

User terminals, single/dual antenna considerations

PART 2 (Second 1.5 hours)

Modulation trade-offs: OFDM vs SC-FDE vs pure time-domain, PAPR and power amplifier impact, terminal equalizer

Linear pre-coder trade-offs: MRT vs ZF/MMSE, possible algorithm simplifications

Power distribution across pre-coding antennas, power normalization

Complexity assessment

Power consumption models

Presenter Biographies

Fredrik Tufvesson is Professor of Radio Systems at the department of Electrical and Information Technology, Lund University, Sweden. He received his Ph.D. in 2000 from Lund University in Sweden. After two years at a startup company, he joined the department of Electrical and Information Technology at Lund University. His main research interests are channel modelling, measurements and characterization for wireless communication, with applications in various areas such as massive MIMO, UWB, mm wave communication, distributed antenna systems, vehicular communication systems and radio based positioning. Fredrik has authored and co-authored around 50 journal papers and 100 conference papers and is currently managing the massive MIMO testbed implementation at Lund University. He was associate editor for IEEE transactions on Wireless

communication 2009-2013 and in 2013 he was co-chairing the wireless communication symposium at ICC in Budapest, Hungary.

Andre Bourdoux received the M.Sc. degree in electrical engineering in 1982 from the Université Catholique de Louvain-la-Neuve, Belgium. He joined IMEC in 1998 and is now Principal Scientist in the "Circuits and Systems for ICT" Department of IMEC. He is a system level and signal processing expert for the mm-wave and sub-10 GHz baseband teams and for the mm-wave radar team. His current research interests are multi-disciplinary, spanning the areas of wireless communications and signal processing, with a special emphasis on broadband systems and emerging physical layer techniques. He holds several patents in these fields. He is the author and co-author of over 120 publications in books and peer-reviewed journals and conferences.