

# Holographic MIMO Communications

Luca Sanguinetti

*CNIT/University Pisa, IT*

## Abstract

Massive MIMO refers to a wireless network technology where the base stations are equipped with a very large number of antennas to serve a multitude of terminals by spatial multiplexing. Thanks to the intense research performed over the last decade, Massive MIMO is today a mature technology. Its advantages in terms of spectral efficiency, energy efficiency, and power control are well understood and recognized. The channel capacity was shown to increase theoretically unboundedly in the regime where the number of antennas grows unboundedly. In practice, however, the number of antennas that fits into the common form factor of a base station site is fundamentally limited. Hence, a natural question is: how can we practically approach the 'infinite antenna' limit? One solution is to integrate a massive (possibly infinite) number of antennas into a compact space, that is, a Holographic MIMO array. Realistic performance assessment of Holographic MIMO communications requires the use of a channel model that reflects the main characteristics of a massive number of antennas in a compact space. This talk considers arbitrary spatially-stationary scattering and provides a representation that captures the essence of electromagnetic propagation and allows to evaluate the capacity of Holographic MIMO systems. The developed framework generalizes the virtual channel representation, which was originally developed for uniform linear arrays.

## Bio



Luca Sanguinetti (SM'15) received the Laurea Telecommunications Engineer degree (cum laude) and the Ph.D. degree in information engineering from the University of Pisa, Italy, in 2002 and 2005, respectively. In 2004, he was a visiting Ph.D. student at the German Aerospace Center (DLR), Oberpfaffenhofen, Germany. During the period June 2007 - June 2008, he was a postdoctoral associate in the Dept. Electrical Engineering at Princeton. From July 2013 to

October 2017 he was with Large Systems and Networks Group (LANEAS), CentraleSupélec, France. He is currently an Associate Professor in the 'Dipartimento di Ingegneria dell'Informazione' of the University of Pisa, Italy. He served as an Associate Editor for IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS and IEEE SIGNAL PROCESSING LETTERS, and as Lead Guest Editor of IEEE JOURNAL ON SELECTED AREAS OF COMMUNICATIONS Special Issue on "Game Theory for Networks" and as an Associate Editor for IEEE JOURNAL ON SELECTED AREAS OF COMMUNICATIONS (series on Green Communications and Networking). Dr. Sanguinetti is currently serving as an Associate Editor for the IEEE TRANSACTIONS ON COMMUNICATIONS and is a member of the Executive Editorial Committee of IEEE

TRANSACTIONS ON WIRELESS COMMUNICATIONS. His expertise and general interests span the areas of communications and signal processing. Dr. Sanguinetti has co-authored the textbooks 'Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency' (2017) and 'Foundations of User-Centric Cell-Free Massive MIMO' (2020). He received the 2018 Marconi Prize Paper Award in Wireless Communications and co-authored a paper that received the young best paper award from the ComSoc/VTS Italy Section. He was the co-recipient of two best conference paper awards: IEEE WCNC 2013 and IEEE WCNC 2014. He was the recipient of the FP7 Marie Curie IEF 2013 "Dense deployments for green cellular networks".