

A RESEARCH JOURNEY

Andrea M. Tonello

www.andreatonello.com

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This brief summarizes my research journey conducted since my graduation in various countries and organizations including my alma mater the University of Padova (Italy), Lucent Bell Labs (NJ USA), the University of Udine (Italy), WiTiKee s.r.l. (Italy), the University of Klagenfurt (Austria) and sabbaticals at the University of Strathclyde (UK), and at UC3M (Spain). My research spanned the following fields (in temporal/importance order):

- A. Machine Learning for Communications
- B. Power Line Communications
- C. Smart Grid and Applications
- D. Wireless Multicarrier Systems
- E. Sensing and Communications
- F. Positioning and Localization
- G. UAV Dynamics, Control and Navigation
- H. Ultra-Wide Band Systems
- I. Communication Theory and Radio Communications
- J. MIMO and Space Time Coding
- K. Circuits and Systems
- L. Robotics and Embedded Systems
- M. Education for ICT

All started with the interest in wireless communications. In this domain, I focused on multicarrier and filter bank modulation schemes (waveform design, efficient realizations, detection methods, synchronization, channel estimation, multiuser systems), MIMO and space time coding (bit-interleaved-space-time coding, iterative decoding), and ultra-wide band systems. I then expended focus by considering radio positioning and localization (particularly angle-of-arrival based), and more in general sensing enabled by radio communications. The hardware implementation and the analysis of hardware impairments has been of particular interest since this has triggered the development of models and digital compensation algorithms.

Power line communications has also become a relevant topic of research. Herein, I looked at several aspects that include channel and noise characterization/modeling, physical layer design, media access control and resource allocation, electromagnetic compatibility, coexistence and convergence with other technologies. The theoretical analysis has been accompanied by a great deal of experimental work that included measurements, and prototyping.

Research on power line communication has fostered interest in the domain of smart grids. Smart metering and grid diagnostics to enable predictive maintenance have been the two most prominent areas of investigation.

More recently, I expanded my domains of research to include aerial robotics where I am focusing on modeling the dynamics and developing control strategies and path planning methods. Then, I have turned my attention to AI and statistical learning with application to communications. In this area, I have followed an information theoretic approach rather than an applied machine learning approach. The idea is to tackle some fundamental challenges in communications, such as mutual information estimation, channel capacity estimation, optimal decoding, end-to-end system design, synthetic channel modeling.

Additional research on circuits and systems has also been conducted including design of high-speed serial interfaces and digital-to-analog-converters.

The main results of my research have been documented in publications and reports (Books, Journals, Conferences, Standard Contributions, Patents, Doctoral Thesis). They are reported below.

BOOKS AND BOOK CONTRIBUTIONS

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