

Title: Principles of Communication over Power Lines: Technologies and Standards

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Duration: 90 minutes

Abstract:

Power lines can be exploited to convey information signals and not only electrical power. The technology is referred to as power line communications (PLC). The first application can be traced back to about 1920, but since then significant progress has been done. Now PLC finds application in several different areas among which home networking, smart metering and the smart grid. It has evolved from original proprietary solutions into worldwide standards.

In this tutorial, we will present the principles of PLC: applications, channel and noise characteristic and modulation approaches that are used in modern systems. The role of PLC together with other communication technologies in the context of the smart grid, e.g., wireless, will be discussed. We will then provide an overview of the main broad PLC standards and protocols among which , IEEE P1901, ITU G.hn, HomePlug AV (mostly used for high speed networking), as well as the narrow band PLC standards, i.e., IEEE P1901.2 and ITU G.hnem (used for low data rate communications).

Contents:

- History and evolution of PLC
- PLC applications
- PLC protocols: what do they specify ?
- Channel and noise main characteristics
- Modulation techniques and the importance of multicarrier modulation
- Communication technologies in the Smart Grid
- Broad band PLC standards: Home Plug AV, IEEE P1901, ITU G.hn
- Narrow band PLC standards: Prime, G3, IEEE P1901.2, ITU G.hnem
- Conclusions

Biography:

Andrea M. Tonello received the Doctor of Engineering degree in Electronics (1996, summa cum laude), and the Doctor of Research degree in Electronics and Telecommunications (2003), both from the University of Padova, Italy. In 1997, he became a Member of Technical Staff at Lucent Technologies Bell Laboratories, where he worked on the development of baseband algorithms for cellular handsets. He worked at Bell Labs - Advanced Wireless Technology Laboratory until 2002, during which time he was appointed Technical Manager and Managing Director of Bell Labs, Italy. Herein, he conducted research on wireless systems, air interface design, performance analysis, and was involved in the standardization of the evolution of 2G and 3G cellular technology.

In 2003, Dr. Tonello joined the Dipartimento di Ingegneria Elettrica, Gestionale e Meccanica (DIEGM) of the University of Udine, Italy, where he is an Aggregate Professor and founder of the Wireless and Power Line Communication Lab. He is also the founder and CEO of WiTiKee, a spin-off company of the lab working in the field of communications for the smart grid.

He has been involved in several European coordinated actions through FP5-FP7 EU funded projects. Dr. Tonello has received several awards, including the Lucent Bell Labs Recognition of Excellence award (2003), the Distinguished Visiting Fellowship from the Royal Academy of Engineering, UK (2010), and the Distinguished Lecturer Award from the IEEE Vehicular Technology Society (2011). He also received the 2007 EURASIP Journal on Advances in Signal Processing Best

Paper Award. He co-authored the papers that received the best paper awards at the IEEE International Symposium on Power Line Communications (ISPLC) in 2010 and in 2011, and at the IEEE Vehicular Technology Conference 2011 Spring.

Dr. Tonello serves as an Associate Editor for the IEEE Transactions on Vehicular Technology and as an Editor for the IEEE Transactions on Communications. He was the General Chair of IEEE ISPLC 2011 in Udine, Italy, and he served as a TPC Co-chair in several other conferences.

He is the Vice-Chair of the IEEE Communications Society Technical Committee on Power Line Communications. (web: www.diegm.uniud.it/tonello)