

Cognitive Radios and Enabling Technologies: UWB for cognitive radios, Aspects of Spectrum Sensing and Detection, Co-existence and Interference Mitigation

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Cognitive radios (CR) intelligently and opportunistically utilize the spectrum to perform communications increasing the efficiency of the spectral usage. Studies have shown that the spectrum is under utilized in the frequency, time and spatial domains and therefore CRs are proposed and encouraged especially by the radio regulatory bodies around the world. Ultra-wideband (UWB) technology is considered as a potential candidate for CR from 3.1GHz to 10GHz. In this tutorial we identify the requirements and enabling technologies for CRs, and address the major technical challenges related to spectrum sensing and incumbent user detection, localizing interferers, and interference avoidance and mitigation. We also present some solutions to these technical challenges considering advanced signal processing and cooperative techniques. Furthermore, the stochastic nature of the spatial and temporal spectral occupancies of the incumbent radios makes the above mentioned tasks more challenging. The

topics covered here consider the UWB-CR as an example, but the fundamentals, challenges and solutions presented are generic to a broader sense. To this aim, the tutorial also introduces the key characteristics of existing and planned UWB communication systems, focusing on technologies adopted by industrial standards and on the potential application scenarios for Cognitive UWB radios.

Biographies: Kandeepan Sithamparanathan (MIEEE '03, SMIEEE '09) received his PhD from the University of Technology, Sydney in 2003. He is currently a Senior Researcher and leads the Cognitive Information Networks (CoIN) group at the Create-Net Research Centre, Italy. Kandeepan was with the National ICT Australia, in Canberra from 2004-2007. He has published more than 40 peer-reviewed papers, and his research interests are on cognitive-radios, statistical communications and signal processing.

Dr. Andrea Giorgetti received the Ph.D. degree from the University of Bologna, Italy in 2003. Since 2006 he is an A/Professor at the II Engineering Faculty, Department of Electronics, Computer Science and Systems (DEIS) at the University of Bologna. Since 2006 he is a Research Affiliate at Massachusetts Institute of Technology, USA. His research interests include ultra-wideband communications and radar, wireless sensor networks and multiple-antenna-systems.

Dr. Luca De Nardis received his PhD from the University of Rome La Sapienza in 2005. Since 2008 he is an A/Professor at the INFO-COM Department. In 2005/2006 he was a visiting-scholar at the Berkeley Wireless Research Center, University of California Berkeley. He also worked as postdoctoral fellow at the same institution in 2006/2007. His research interests focus on UWB, ad-hoc networks organization, MAC, positioning and routing protocols.

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