

T3. Cognitive Radio, Software-Defined Radio, and Adaptation of Wireless Mobile Radio Systems

Abstract:

Today's wireless services and systems have come a long way since the rollout of the conventional voice-centric cellular systems. The demand for wireless access in voice and multi-media applications has been increasing. As a result of the convergence of computing, content, and entertainment with communication, the radio equipments have become part of our daily lives. It came to a point where we cannot live without them anymore. We cannot interact, chat, find our direction, have fun or sometimes even think without them. We can leave everything behind, but, cannot go anywhere without them. The fun is actually just starting. Wait until when you see the intelligence is added to these radios. Equipped with the capability and flexibility of software defined radios and combined with the machine learning, a new concept which is referred as Cognitive Radio has emerged in the wireless world. Cognitive radios can sense and be aware of its radio, user, and network environments, and react to these by adapting the operation parameters in order to maximize user satisfaction. With such a capability and intelligence, these radios can do amazing things such as learning from the past experiences of its user and about themselves to better adapt to various conditions in the future. They make our homes much smarter; make our cars and driving experience more enjoyable; reduce the health concerns by allowing more controlled electromagnetic radiation; solve interoperability problems between various networks, and eventually be our best friends. Considering the importance of radios in all aspects of life, Cognitive Radios can even save lives in disasters. In the light of all these remarkable benefits, the social, economical, and environmental impact of cognitive radios are expected to be significant.

This tutorial targets to discuss the cognitive radio, software defined radio, and adaptive radio concepts from several aspects. Adaptive resource management, adaptive transmission technologies and receiver adaptations techniques for the evolution of wireless communication systems will be reviewed. The enabling techniques for these adaptations that requires sensing and measurements of some radio and interference parameters, like Doppler spread estimation, link quality estimation, signal-to-noise ratio estimation, interference temperature measurement, post-processing channel quality estimations (CRC estimation, Bit-error-rate estimation, frame erasure rate estimation) etc., will be covered.

Speaker's Biography :

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Dr. Arslan has received his PhD. degree in 1998 from Southern Methodist University (SMU), Dallas, Tx. From January 1998 to August 2002, he was with the research group of Ericsson Inc., NC, USA, where he was involved with several project related to 2G and 3G wireless cellular communication systems. Since August 2002, he has been with the Electrical Engineering Dept. of University of South Florida. In addition, he has worked as part time consultant for various companies and institutions including Anritsu Company, The Scientific and Technological Research Council of Turkey- TUBITAK, Lecroy, and XG technologies.

Dr. Arslan's research interests are related to advanced signal processing techniques at the physical layer, with cross-layer design for networking adaptivity and Quality of Service (QoS) control. He is interested in many forms of wireless technologies including cellular, wireless PAN/LAN/MANS, fixed wireless access, and specialized wireless data networks like wireless sensors networks and wireless telemetry. The current research interests are on UWB, OFDM based wireless technologies with emphasis on WIMAX and IMT-Advanced, and cognitive

and software defined radio. He has served as technical program committee chair, technical program committee member, session and symposium organizer, and workshop chair in several IEEE conferences. He is a member of the editorial board for “IEEE Transactions on Communications “, “Wireless Communication and Mobile Computing Journal”, and “Journal of Electrical and Computer Engineering” by Hindawi Publishing Corporation. Dr. Arslan is a senior member of IEEE.