ROBUST TRANSCEIVER DESIGN FOR VEHICLE-TO-VEHICLE DEDICATED SHORT-RANGE COMMUNICATIONS

Postgraduate Projects in Electronics Engineering Offered at the Faculty of Science
Universidad Autónoma de San Luis Potosí, Mexico

PROJECT DESCRIPTION: The design of dedicated short-range communication (DSRC) systems enabling the exchange of information between vehicles on the move has become a major objective of the telecommunications industry for this decade. The potential applications of vehicle-to-vehicle (V2V) DSRC systems have caught the interest of car manufacturers and government agencies responsible for road safety and traffic management, such as the U.S. Department of Transportation. Furthermore, the unique characteristics of these systems pose a series of challenges that scientists and engineers find fascinating and worthy of attention.

Roughly speaking, DSRC systems differ from conventional mobile communication systems in that: 1) Users (vehicles) may communicate with each other without relying on a dedicated coordination element (base station or access point); 2) both source and destination stations are mobile, and they can move at high vehicular speeds (> 120 km/h); 3) communications between users take place at ground level, so that the effects of three-dimensional scattering become significant; 4) the system's range is small, typically of about 400 meters. These differences call for the design of novel transceivers for V2V DRSC systems that achieve a high spectral efficiency under harsh propagation conditions. A breakthrough towards the design of such transceivers came recently in the form of an amendment to the IEEE 802.11 standard. This amendment, referred to as the IEEE 802.11p, provides specifications for the air interface of DSRC systems at the physical (PHY) and medium access control (MAC) layers. The amendment, however, is a simple variation of the 802.11 standard for fixed wireless local area networks, and questions have risen among engineers concerning the performance of DSRC systems based on the IEEE 802.11p standard. For example, it has been shown recently that the channel estimation mechanisms described in the IEEE 802.11p do not work properly when the source and destination stations are moving at high speeds.

Aiming at contributing to the creation of a fully operational V2V DSRC system, we offer the opportunity to pursue a Master or PhD in electronics engineering at the Faculty of Science of the Universidad Autónoma de San Luis Potosí (UASLP), Mexico, working on the design of a robust transceiver for V2V DSRC systems. Research topics for the offered positions include:

- Modeling and simulation of short-range wideband multiple-input multiple-output (MIMO) V2V channels
- Modulation schemes, channel estimation, and frequency synchronization for MIMO OFDM systems in rapidly time-varying propagation environments
- Power control mechanisms for multi-user DSRC systems

APPLICANTS' PROFILE

Interested applicants should have:

- A solid background in mathematics, wireless communications, and signal processing
- A Moderate/Comprehensive knowledge of English is essential
- Experience in using mathematical and numerical tools such as MATLAB

PROJECT ADVISORS

Dr. Carlos A. Gutiérrez
Associate Professor
Faculty of Science
Universidad Autónoma de San Luis Potosí
Email: cagutierrez@fc.uaslp.mx

Dr. Martin Luna-Rivera
Associate Professor
Faculty of Science
Universidad Autónoma de San Luis Potosí
Email: mlr@uaslp.mx