

IEEE Communications Society Distinguished Lecturer Seminar

**Designing Ultra-Wide Bandwidth (UWB) Receivers for
Multi-User Interference Environments**

Abstract

Ultra-wide bandwidth (UWB) wireless is envisioned as a license-free replacement for cables and wires, able to transmit at extremely high data rates over short distances and has been dubbed “Bluetooth on steroids”. The principles and structures of time-hopping (TH) ultra-wide bandwidth (UWB) wireless systems are recalled and the suitability of the conventional matched filter (correlator) digital receiver for TH-UWB applications is discussed. Insights into the performance of the matched filter TH-UWB receiver is gained from study of examples of the simulated probability density function of the TH-UWB multiple access interference. Some new TH-UWB receiver designs are proposed based on examining the characteristics of the simulated multi-user interference density functions. Soft-limiting and zonal receiver structures are intuitively motivated and shown to outperform the conventional matched filter UWB receiver by many dB's in signal-to-noise ratio (SNR). A p-order metric receiver is also proposed and its superior performance established. The improved receiver performances are explained using maximum likelihood (ML) receiver design principles. The application of the new signal detection structures in modified Rake receiver designs for multipath fading UWB channels is explored. Recent preliminary results for an UWB receiver currently under study that is based on an alpha-stable interference model will also be presented.