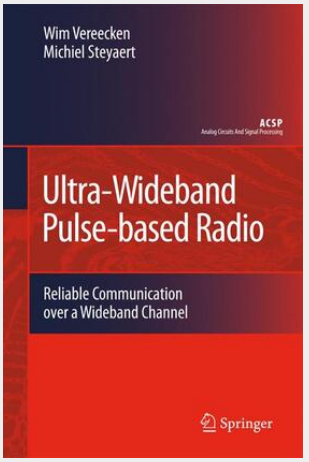
Vereecken / Steyaert

Ultra-Wideband Pulse-Based Radio

Reliable Communication Over a Wideband Channel



Today’s booming expanse of personal wireless radio communications is a rich source of new challenges for the designer of the underlying enabling te- nologies. Personal communication networks are designed from a fundam- tally different perspective than broadcast service networks, such as radio and television. While the focus of the latter is on reliability and user comfort, the emphasis of personal communication devices is on throughput and mobility. However, because the wireless channel is a shared transmission medium with only very limited resources, a trade-off has to be made between mobility and the number of simultaneous users in a con?ned geographical area. Accord- 1 ing to Shannon’s theorem on channel capacity, the overall data throughput of a communication channel bene?ts from either a linear increase of the tra- mission bandwidth, or an (equivalent) exponential increase in signal quality. Consequently, it is more bene?cial to think in terms of channel bandwidth than it is to pursue a high transmission power. All the above elements are embodied in the concept of spatial ef?ciency. By describing the throughput of a system 2 in terms of bits/s/Hz/m, spatial ef?ciency takes into account that the use of a low transmission power reduces the operational range of a radio transmission, and as such enables a higher reuse rate of the same frequency spectrum.

Today's booming expanse of personal wireless radio communications is a rich source of new challenges for the designer of the underlying enabling technologies. Because the wireless channel is a shared transmission medium with only very limited resources, a trade-off must be made between mobility and the number of simultaneous users in a confined geographical area. Ultra-Wideband Pulse-based Radio lays the foundations of a new radio transceiver architecture, based on the Ultra-Wideband pulse-based radio principle. Instead of a continuous-time modulated carrier, the pulse-based radio system uses short electromagnetic pulses with a wide spectral footprint. This has considerable advantages for the reliability of a wireless link in an indoor environment. However, what is not accounted for in most high-level theoretical perspectives, is that a wide transmission bandwidth opens up a Pandora's box of many complications at receiver side. A real-world wireless channel, for example, suffers from multipath reflections: multiple, delayed versions of the same signal arrive at the receive antenna and start to interfere with one another, an effect that is known as intersymbol interference. Also, a wide transmission band is a wide open door for in-band interfering signals, caused by other transmitters in the same frequency band. A specially crafted interferer suppression and signal reconstruction (ISSR) algorithm is presented in this book. Without active intervention from the transmitter, the ISSR algorithm is capable of on-the-fly cleaning of frequency bands which have fallen victim to multipath fading or narrowband interference. The unique blend of pulse-based radio, a simple modulation scheme and a powerful signal reconstruction system make the presented pulse-based radio system a very promising alternative for the high-end (but complex) OFDM-based modulation schemes currently used in many WLAN applications.

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