Abstract

An analog approach to interference suppression in ultra-wideband receivers

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Because of the huge bandwidth of Ultra-Wideband (UWB) systems, in-band narrowband interference may hinder receiver performance. In this dissertation, sources of potential narrowband interference that lie within the IEEE 802.15.3a UWB bandwidth are presented, and a solution is proposed. To combat interference in Multi-Band OFDM (MB-OFDM) UWB systems, an analog notch filter is designed to be included in the UWB receive chain. The architecture of the filter is based on feed-forward subtraction of the interference, and includes a Least Means Squared (LMS) tuning scheme to maximize attenuation. The filter uses the Fast Fourier Transform (FFT) result for interference detection and discrete center frequency tuning of the filter. It was fabricated in a 0.18 Ã‚Âµm process, and experimental results are provided. This is the first study of potential in-band interference sources for UWB. The proposed filter offers a practical means for ensuring reliable UWB communication in the presense of such interference. The Operational Transconductance Amplifier (OTA) is the predominant building block in the design of the notch filter. In many cases, OTAs must handle input signals with large common mode swings. A new scheme for achieving rail-to-rail input to an OTA is introduced. Constant gm is obtained by using tunable level shifters and a single differential pair. Feedback circuitry controls the level shifters in a manner that fixes the common mode input of the differential pair, resulting in consistent and stable operation for rail-to-rail inputs. As the new technique avoids using complimentary input differential pairs, this method overcomes problems such as Common Mode Rejection Ratio (CMRR) and Gain Bandwidth (GBW) product degradation that exist in many other designs. The circuit was fabricated in a 0.5Ã‚Âµm process. The resulting differential pair had a constant transconductance that varied by only Ã‚Â±0.35% for rail-to-rail input common mode levels. The input common mode range extended well past the supply levels of Ã‚Â±1.5V, resulting in only Ã‚Â±1% fluctuation in gm for input common modes from -2V to 2V.