Abstract

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A Realizable Bandwidth Efficient Pulse Shaping Approach using Digital Multirate Filters

The transmission of signals free of inter-symbol interference (ISI) within limited bandwidth, has always been a challenge for high bit rate communication systems. As a result, the need for bandwidth efficient pulse shaping schemes arises. A pulse shaping filter is required to band-limit the signal and control ISI, in addition to being efficiently realizable using signal processing techniques. Moreover, the design of the pulse shaping affects the probability of error, hence affects the power efficiency. Pulse shaping using multirate filters is presented as an approach to satisfy all the previously stated requirements of a pulse shaping filter. Two important aspects characterize multirate pulse shaping: its efficient realization, in addition to its bandwidth- and power- efficiency. Both aspects are investigated and compared to other conventional pulse shaping approaches such as raised cosine (RC) filtering and correlative level coding (CLC). The error performance of multirate pulse shaping is examined over additive white Gaussian noise (AWGN) channel for different filter lengths and different digital modulation schemes. Furthermore, the bandwidth efficiency is also investigated for different filter lengths. It is found that there is a tradeoff between power and bandwidth efficiency, upon increasing the MR filter length. Compared to CLC with symbol-by-symbol detection, multirate pulse shaping offers a better power efficiency. When compared to RC, multirate pulse shaping provides a significant enhancement in bandwidth efficiency.