

Interleaving Technologies for Signal Design

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Pseudorandom sequences are widely used in computer science and engineering including applications to spread spectrum communication systems, radar systems, signal synchronization, simulation and cryptography (S. W. Golomb and G. Gong, *Signal Design for Good Correlation*, Cambridge University Press, 2005). The sequences with low cross correlation employed in CDMA communications can successfully combat interference from the other users who share a common channel. We do a survey on the recent works on constructing sequence families (sets) with low cross correlation or with zero correlation zone (ZCZ) by interleaving technologies.

Interleaved structure is a well-known period extending method, which was first introduced by Gong (G. Gong, *IEEE Trans. Inform. Theory*, 41, 400-411, 1995). The interleaving technologies can be used to generate many types of sequence families. Gong constructs two classes of sequence families with good correlation property and large linear complexity by interleaving two ideal autocorrelation sequences. He, Panario and Wang (J. J. He, D. Panario and Q. Wang, *Contemporary Mathematics*, 518, 209-223, 2010) extend the construction to a general interleaved construction which uses two sequences of different length, and one sequence may not have two-level autocorrelation.

For various quasi synchronous (QS) CDMA systems, in order to reduce or eliminate the multiple access interference and multipath interference, it is required to design a set of spreading sequences which are mutually orthogonal within a designed shift zone, called orthogonal zone. For traditional orthogonal sequences, such as Walsh sequences, the orthogonality is destroyed at a relative shift between two sequences, that is, their orthogonal zone is 0. To overcome the zero-length orthogonal zone the concept of generalized orthogonality also called zero correlation zone (ZCZ) or zero correlation window (ZCW) is introduced by Fan and Hao (P. Z. Fan and L. Hao, *IEEE Trans. Fundamentals*, vol. E83-A, no.11, 1-16, 2000) and it opens a new direction in spreading sequence design. Zhou, Tang and Gong construct a ZCZ sequence set by interleaving one length- N perfect sequence (Z. Zhou, X. Tang and G. Gong, *IEEE Trans. Inform. Theory*, vol. 54, no. 9, 4267-4273, 2008). Then Hu and Gong generalize the idea and construct a ZCZ sequence set by interleaving M ZCZ sequences (H. Hu and G. Gong, *IEEE Trans. Inform. Theory*, vol.56, no.4, 1702-1713, 2010). We present the results of these works and the open questions in this direction.