Optimal Variable-Weight Optical Orthogonal Codes

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Abstract

In 1996, Yang introduced multimedia optical CDMA communication system employing variable-weight optical orthogonal codes (OOCs). In this CDMA system, the subscribers with different code weights will have different bit error rate (BER) performance. The codewords of low code weight can be assigned to the low-QoS (Quality of Services) applications and high code weight codewords can be assigned to high-QoS requirement applications. Hence, the multi-weight property of the OOCs enables the system to meet multiple QoS requirements. In this talk, the upper bound on the size of variable-weight OOCs is improved, a cyclic t-(v, W, λ, Q) packing is introduced to construct a variable-weight OOC, an equivalence between optimal cyclic packing and optimal variable-weight optical orthogonal code is established. Recursive constructions for optimal 2-CP$(W, 1, Q; v)$s are also presented. By using skew starters and these constructions, infinite classes of optimal $(v, W, 1, Q)$-OOCs are obtained for $W = \{3, 4\}$ and $\{3, 5\}$.

Keywords: cyclic difference family, cyclic difference matrix, cyclic packing, optical orthogonal code, packing design, skew starter, variable-weight OOC.