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EXPLICIT CONSTRUCTIONS FOR TYPE-1 QC-LDPC CODES WITH LARGE GIRTH

Abstract

Quasi-cyclic (QC) low-density parity-check (LDPC) codes with large girth have recently attracted much attention, since they have low encoding complexity and generally outperform random LDPC codes for short to moderate block lengths. From Sidon sequence over $\mathbf{Z}[P]$, two classes of type-1 ($J = 3, L$) QC-LDPC codes are explicitly proposed with block length $L*L*P$ and with girth at least ten. For the first method, any Sidon sequence over $\mathbf{Z}[P]$ (P odd) with cardinality no smaller than L (L odd) corresponds to a class of type-1 ($3, L$) QC-LDPC codes with girth at least ten. For the second one, any Sidon sequence over $\mathbf{Z}[P]$ (P prime) with cardinality no smaller than L (L arbitrary) corresponds to a class of type-1 ($3, L$) QC-LDPC codes with girth at least ten. The second method also works for some values of P which are not prime. Compared with the method from 3-D lattices, which can also generate type-1 QC-LDPC codes with girth at least ten, the main advantage of the new methods is that the construction process is much more simple, and L is not necessarily a prime integer. Simulation results show that the new type-1 QC-LDPC codes outperform the girth-8 QC-LDPC codes constructed by Sidon sequence or the earliest sequence, and perform almost as well as Bocharova's shortest girth-12 QC-LDPC codes.