

Abstract

With advancing quantum technologies, efficient entanglement-assisted quantum error-correcting codes (EAQECCs) are critical for system reliability, yet traditional QECCs lack parameter flexibility and face strict minimum distance constraints. Using multi-twisted Reed-Solomon (MTRS) codes, this work derives existence conditions of Hermitian hull for MTRS codes, explores their links to linear complementary dual (LCD) codes, and produces two classes of maximum distance separable EAQECCs (MDS EAQECCs) and two classes of MDS Hermitian LCD codes. These MDS EAQECCs enable flexible code length adjustment and improved minimum distances via twisting operations, and can be upgraded to maximally entangled (ME)-MDS EAQECCs for practical quantum communication.