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Length-Maximal Nonlinear Codes with Given Singleton Defect–Structure and Bounds

For a linear $[n,k,d]_q$ code, the columns of a generator matrix form a projective arc, and the maximum length is governed by the classical maximal-arc bound $n \leq (s+1)(q+1)+k-2$, where s is the Singleton defect. We show that this same bound holds for all $(n,q^k,d)_q$ codes, with no assumption of linearity. Codes attaining the bound, which we call length-maximal, are necessarily symbol-uniform and have a sharply constrained distance spectrum. They also satisfy a divisibility condition on s that mirrors, but is weaker than, the condition forced on linear codes. An equivalent form of the bound yields an improved Singleton-type inequality that recovers and extends a result of Guerrini, Meneghetti, and Sala for binary systematic codes. When the defect is large, the bound tightens in discrete steps. We also identify several conditions under which nonlinear codes satisfy the Griesmer bound, and close with open problems, grounded by the central question: *can genuinely nonlinear length-maximal codes exist for parameters where no linear codes do*?