The Rate/Performance Tradeoffs of Focused Error Control Codes

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Let B be a set of non-zero elements of F_q ($q > 2$); we say a code is (t_1, t_2)-focused on B if it can correct up to $t_1 + t_2$ errors *provided* at most t_1 of those errors lie outside B. The strategy is to offer different levels of protection against "common" errors – those in B – and "uncommon" errors. (The motivating example: correction of single-bit-per-byte errors with codes over F_{2^b}.)

This talk will compare the performance and rates of (t_1, t_2)-focused codes with those of traditional $t_1 + t_2$-error correcting codes. We show that, at high SNR, if a channel is sufficiently "skewed" – that is, if the noise character is Z and $P\{Z \notin B | Z \neq 0\} < \gamma_{crit}$ – then the performance of a (t_1, t_2)-focused code is essentially identical to that of a $t_1 + t_2$-error correcting code; this claim is derived analytically and verified by simulation results. Since (t_1, t_2)-focused codes can be constructed with higher rates than can $t_1 + t_2$-error correcting codes, they offer for these "skewed" channels new advantages in terms of rate and/or performance. We include in the talk an analysis of the tradeoffs offered by focused codes for M-ary PSK and M-ary ASK modulation schemes.