Capacity of RMS Bandlimited Gaussian Multiple-Access Channels

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Continuous-time additive white Gaussian noise channels with strictly time-limited and root mean square (RMS) bandlimited inputs are studied. RMS bandwidth is equal to the normalized second moment of the spectrum, which has proved to be a useful and analytically tractable measure of the bandwidth of strictly time-limited waveforms.

We show how the classical formulas for the capacity of strictly bandlimited single and two-user channels change under the RMS bandwidth measure. In addition, we consider channels where the inputs are further constrained to be Pulse Amplitude Modulated (PAM) waveforms. We analyze those channels under the assumption that the transmitters are symbol-synchronous and we find the pair of pulses that achieves the boundary of the capacity region. The shapes of the optimal pulses depend not only on the bandwidth but also on the respective signal-to-noise ratios.

The Effect of Coding on the Reliability of Computer Memories

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We consider the problem of the Mean Time to Failure (MTTF) of a random access memory which is protected by an on-chip single-error-correcting code. In a previous paper we studied the implementation of a code on a memory array and analyzed the effect on the yield (the probability that every bit on the memory array can be read correctly.) We restrict our attention to single-cell failures, since the purpose of coding is to combat single-cell defects.

We assume that cell failures form a Poisson process with parameter λ and that cell failures in a codeword form a Poisson process of intensity $n\lambda$. We take into account the event that not all codewords on the memory array are defect-free.

We derive an expression for the MTTF of a coded memory array and analyze its behavior as p varies, where p is the probability that a cell is defective at $t = 0$. As $p \to 0$ the MTTF of coded arrays is proportional to $N^{-\frac{1}{2}}$ (where N is the size of the memory), compared to N^{-1} for the uncoded case. Coding therefore provides two benefits: it significantly increases the lifetimes of the memories, and slows down the rate of decrease of the MTTF as N increases.