

EEI-KOLLOQUIUM

Staircase Codes: Error-correction for High-Speed Fiber-Optic Channels

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We describe staircase codes, a new class of error-control codes suitable for high-speed optical communications. One sample design, targeted at 100Gb/s optical transport networks, yields an ITU-T G.709-compatible staircase code with rate $R=239/255$ for which FPGA-based simulation results exhibit a net coding gain (NCG) of 9.41 dB at an output error rate of 10^{-15} , an improvement of 0.42 dB relative to the best code from the ITU-T G.975.1 recommendation. An error floor analysis shows that this code has an error floor below 10^{-20} . These codes can be exploited in higher-order modulation schemes incorporating signal shaping, to achieve reliable communication near the estimated capacity of fiber channels. For example, one design yields a practically achievable spectral efficiency within 0.62 bits/s/Hz of the estimated capacity of a long-haul fiber channel having a length of 2000 km.