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Analysis of free space optical interconnects based on non-diffracting beams

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Abstract: The performance of free space optical interconnects utilizing non- diffracting Bessel beams is analyzed. The integral optical channel?channel cross-talk, the detector pre-amplifier thermal noise, and the resulting signal-to-noise ratio (SNR) are used as system parameters to characterize optical interconnects in terms of their channel density. We show that pitch and fill factor of the detector can be exploited as a system design parameter. Our analysis shows that the side lobes of Bessel beams act as a major source of cross-talk, which severely limits the number of spatial channels that can be realized. The use of Bessel beams, nevertheless, outperforms conventional Gaussian beams, particularly over larger propagation distances. The effects of increasing the transmitted power as well as decreasing the channel bandwidth on the SNR are investigated as well.