

**The use of nonlinear element for signal enhancement in
a grating based all-optical pattern recognition system**

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We demonstrate an elementary grating-based OCDMA code generation and recognition system incorporating a nonlinear optical loop mirror (NOLM) within the receiver. We show that the NOLM can act as a nonlinear processing element capable of reducing both the pedestal associated with conventional matched-filtering, and the width of the associated code-recognition pulse. The pedestal rejection allows for an improved code recognition signal to noise ratio relative to simple matched filtering alone and reduced intra- and inter-channel interference noise due to code overlap. The system benefits of using the NOLM are experimentally demonstrated under both single and multi user operation within a variety of both 7- and 63-chip, 160 Gchip/s code generation, recognition and transmission experiments based on the use of bipolar SSFBG coding:decoding pairs. Incorporation of the NOLM is shown to allow error-free, penalty free operation at data rates as high as 2.5Gbit/s under single user operation, and to provide error-free performance with reduced power penalty in two-user experiments. The narrowed pulse recognition signature offers major advantages in terms of the further all-optical processing of decoded signals, such as code regeneration and recoding. In our experiments we used a fibre based NOLM however, semiconductor based nonlinear devices should offer similar benefits.