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Optical Code Division Multiple Access encoders and decoders based on Superstructured Fiber Bragg Gratings

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We report a range of elementary optical coding and decoding experiments employing superstructured fiber Bragg grating (SSFBG) components for optical code division multiple access (OCDMA) system. Firstly, we perform a comparative study of the relative merits of bipolar and unipolar coding:decoding schemes and show that the SSFBG approach allows high quality unipolar and bipolar coding. A performance close to that theoretically predicted for 7-chip, 160 Gchip/s M-sequence codes is obtained. Secondly, we report the fabrication and performance of 63-chip, 160 Gchip/s, bipolar Gold sequence grating pairs. These codes are at least 8 times longer than those generated by any other scheme based on fiber grating technology so far reported. Finally, we describe a range of transmission system experiments for both the 7 and 63-bit bipolar grating pairs. Error-free performance is obtained over transmission distances of ~25km of standard fiber. In addition, we have demonstrated error-free/penalty-free performance under multi-user operation (two simultaneous users). Our results highlight the precision and flexibility of our particular grating writing process and show that SSFBG technology represents a promising technology not just for OCDMA but an extended range of other pulse shaping, optical processing applications.