

# Optical Fiber Mirror Using Cascaded Second-order Nonlinearity

**I. V. Mel'nikov and P. St. J. Russell**

*Optoelectronics Research Centre, University of Southampton, Hampshire SO17 1BJ, United Kingdom*

Phone: +44 703 593083, Fax: +44 703 593149

In recent years there has been a revival of interest in frequency conversion based on second-order nonlinearities. This interest has been primarily due to progress in the periodic poling of crystals [1] and silica glasses [2]. These new technologies have permitted efficient quasi-phase matched frequency conversion in both bulk and waveguide geometries. On the other hand, studies of frequency down-conversion have demonstrated that the pump wave can experience a nonlinear phase shift if it is accompanied by a weak injected second harmonic signal [3]. This has become known as the *cascaded second-order effect*.

In this report, using the earlier concept of distributed feedforward parametric frequency conversion in quasi-phase matched structures [4], a further development using an injected second harmonic signal is proposed. This is a nonlinear Sagnac loop mirror, based on the cascaded effect, in a loop created by connecting the ends of a  $\chi^{(2)}$  fiber grating. A comprehensive analysis is used and enables us to create experimental set-up with useful output characteristics.

## References

1. H. Ito et al., Electron. Lett. **27**, 1221 (1991).
2. P. G. Kazansky et al., Opt. Lett. **19**, 1141 (1994).
3. P. St. J. Russell, OSA Technical Digest **10**, 252 (1993).
4. P. St. J. Russell, IEEE J. Quant. Electr. **27**, 830 (1991).