Fabrication and applications of dispersion varying optical fibre

D.J. Richardson

Optoelectronics Research Centre
Southampton University
Southampton U.K.

Tel +44 1703 594524
Fax +44 1703 593142
Email: DJR@ORC.SOTON.AC.UK

The evolution of light propagating in an optical fibre is determined by the complex interplay of the distributed linear (e.g. loss and dispersion) and third order nonlinear effects that the signal experiences as it propagates through the system. The ability therefore to independently control any of these physical properties of the medium along a fibre's length is therefore an extremely enabling capability, offering the possibility of distributed optical waveform control.

Significant, continuous, distributed control of a fibre's loss or nonlinear response would be difficult to implement, however the dispersion of an optical fibre is a strong function of the waveguide design which can be readily controlled during the fibre fabrication. Over the past few years, we have developed technology for the fabrication of dispersion varying fibre based on fibre core diameter variation during the draw. We have now demonstrated low loss (<0.25 dB/km) fibres with accurate dispersion control (+/- 0.15 ps/(nm.km)) over length scales ranging from 10m to 40km, with dispersion variation in both the normal and anomalous regimes.

In this presentation, we shall describe the fabrication of such fibres and review a number of the applications of the technology demonstrated to date. These include high frequency (>30 GBit/s) bright and dark soliton generation, pico/femtosecond pulse compression and the demonstration of effectively loss-less, ultra-short (<5ps) soliton pulse transmission using exponentially tapered dispersion fibres over distances in excess of 4000km. Options for improved fibre fabrications and future applications of the technology will be discussed