

Nonlinear Fiber Optics and Supercontinuum Generation – New Fibers, New Opportunities

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We present a tutorial review of selected recent advances in nonlinear fiber optics that have been enabled by the availability of new classes of fiber with enhanced nonlinearity and engineered dispersion.

Nonlinear pulse propagation in the new generation of highly nonlinear and photonic crystal fibres has led to a number of exciting new opportunities in ultrafast optics. Perhaps the most spectacular nonlinear effect that has been observed is supercontinuum generation, where spectrally-continuous optical fields spanning from the visible to the infrared are generated using widely available ultrafast sources. Surprisingly, however, the underlying physics of supercontinuum generation in photonic crystal fibre is still not widely understood, despite having been first presented in the case of standard fibre as early as 1985!

The first objective of this talk will be to address this problem, and to review supercontinuum generation over the full range of experimentally-reported parameters from the nanosecond to the femtosecond regime. We will discuss the dominant frequency conversion mechanisms in each case, with the intention of providing a self-contained overview suitable for the non-specialist. Stability properties and the application to optimizing supercontinuum sources tailored to particular application needs will also be considered. Following this discussion of supercontinuum generation, a survey of other recent applications of novel fibers will be presented, spanning applications in frequency conversion, optical regeneration and the study of novel self-similar propagation effects in optical amplifiers and dispersion-decreasing fibres.

References

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