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(UG*) (POS-52) Comparison of Pulse-Propagation Equations using Raman Effect and Kerr Instability Amplification

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The development of Photonic Crystal Fibers in the 1990s has led to considerable research on Supercontinuum generation, in which nonlinear effects play a big role. The majority of simulation work done to model the nonlinear Raman effect has been using the Generalized Nonlinear Schrödinger Equation (GNLSE) - which is computationally efficient but lacks accuracy in broadband modelling due to its reliance on the Slow Varying Envelope Approximation. Ultra-broadband spectra have been modelled using other equations however, such as the Forward Maxwell Equation (FME) - which makes minimal approximations - and an equation developed by Silva, Weigand and Crespo (SWCE) - another computationally efficient model used to simulate Cascaded Four-Wave Mixing.

Nonlinear media have also been employed for a recent amplification method called Kerr Instability Amplification (KIA). However, the only simulations done to test KIA so far have been using the Forward Maxwell Equation. In this work, we simulated both these effects using all three equations and compared them. We find that they all perform similarly in modelling the Raman effect, but the GNLSE exhibits noticeably lower amplification in KIA simulations. The SWCE shows similar results to the FME while being substantially more efficient. We expect that understanding how these equations compare in simulating these nonlinear effects will prove useful to the photonics community.

Keyword-1

Kerr Instability Amplification

Keyword-2

Pulse Propagation

Keyword-3

Raman Effect

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