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2:45pm - 3:15pm

Invited

Real-Time Measurement of Ultrafast Instabilities in Optical Fibre Systems

John M DUDLEY[1], Piotr RYCZKOWSKI[2], Mikko NÄRHI[2], Cyril BILLET[1], Lauri SALMELA[2], Juha TOIVONEN[2], Jean Marc MEROLLA[1], Pierre Ambroise LACOURT[1], Goery GENTY[2]

1. FEMTO-ST Institute, UMR 6174 CNRS-Université Bourgogne Franche-Comté, Besançon, France; 2. Tampere University, Finland

Since the first demonstration of Kerr lens modelocked Ti:sapphire laser in 1990, the field of ultrafast optics has seen dramatic simultaneous advances in the development of ultrafast sources and advanced measurement techniques used to characterize them. Although there has naturally been a strong focus on regimes of stable pulse operation, there has been recently significant interest in the studying transient dynamics and regimes of instabilities, as such unstable phenomena have fundamental interdisciplinary links with wider areas of physics associated with turbulence and extreme events. These studies have been stimulated by dramatic advances in the availability of real-time measurement techniques for ultrafast non-repetitive optical signals, carried out either in the spectral domain using the dispersive Fourier transform to measure single-shot spectra with sub-nm accuracy, or in the time domain using a time lens technique to obtain intensity profiles with sub-picosecond resolution. In this presentation, we will review our recent work in this area, and present in particular the simultaneous use of spectral and temporal techniques to characterize the instabilities observed during the growth and decay of dissipative soliton structures in a fiber laser. These results provide a unique picture of the internal evolution of dissipative solitons in a laser system, and we anticipate further applications of this approach in optimizing laser performance and stability under a wider range of conditions. We will also report results applying the techniques of machine learning to the analysis of real-time spectral data of modulation instability experienced by ultrashort pulses in an optical fibre.