Feedback bandpass filter effects in the dynamics of an optoelectronic wavelength nonlinear delay system

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In a previous work [1], we studied experimentally, numerically, and analytically the response of a nonlinear optical oscillator subject to a delayed broadband bandpass filtering feedback. Its dynamical response was described by an integro?DDE that differs from Ikeda family of first order DDEs, only by the presence of an integral term. In this talk, we report on an optoelectronic wavelength nonlinear delay dynamics ruled by a feedback tunable bandpass filter. The particular influence of this filtering feedback determining the differential process of the dynamics is presented both experimentally and numerically. Multiple time scales phenomena like slow and fast periodic regime, regular or chaotic breathers, envelope dynamics, complex self pulsing, and fully developed chaos are observed ranging over several orders of magnitude, under various parameter and filtering feedback conditions. Time-frequency approach with wavelet transform is proposed in order to analyze multi-scale behaviour of the recorded time series. The influence of the characteristic delay frequency, and its location in the Fourier spectrum with respect to the filtering feedback cut-off is also reported. The observed behaviour offer attractive potential for many applications, e.g. in chaos?based communications, high spectral purity microwave generation, random number generation and chaos computing.

[1] M. Peil, M. Jacquot, Y.C. Kouomou, L. Larger, T. Erneux, "Routes to Chaos and Multiple Time Scale Dynamics in Broadband Bandpass Nonlinear Delay Electro-Optic Oscillators", Physical Review E, Vol.79, 026208, February 2009.