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Autores Sicre, Enrique y Duchowicz, Ricardo

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PULSE CHARACTERIZATION USING A WIGNER DISTRIBUTION FUNCTION APPROACH

Enrique E. Sicre[1] and Ricardo Duchowicz[2,3]
1 Instituto de Tecnología, UADE, Buenos Aires, Argentina
2 Centro de Investigaciones Ópticas, Casilla 3, Gonnet, La Plata, Argentina
3 Facultad de Ingeniería, Universidad Nacional de La Plata, La Plata, Argentina

e-mail: ricardod@ciop.unlp.edu.ar

Several works related with fiber optic pulse transmission were carried out in recent years using methods based on dual phase time-frequency representations like the fractional Fourier transform or the Wigner distribution function (WDF) [1-6]. Since their optical implementations involve a tandem of quadratic temporal modulation and second-order chromatic dispersion they become an adequate tool either to analyze distorted pulses transmitted by fiber optic links or to synthesize pulses with a required waveform shaping. In this paper we extend to the time domain a previously developed method to analyze the point spread function of a spatial optical imaging system from the study of the WDF associated with the pupil function [7]. We propose an equivalent system formed by a dispersive component, such as a linearly chirped fiber Bragg grating (LCBG), and an electro-optic modulator (EOM), both acting as a temporal imaging device. The properties of the modulation function associated with the EOM (i.e., modulation bandwidth, quadratic and higher-order terms) modify the output pulse shape. By implementing the WDF in the time-frequency domain, an algorithm is developed from which the irradiance of the output pulse shape is obtained. Thus, some applications are performed such as pulse compression under fiber optic dispersive transmission and pulse reshaping under asymmetric pulse distortions due to nonlinear and/or third-order chromatic dispersive pulse transmission.

Keywords: Pulse transmission; Pulse reshaping; Wigner distribution function analysis

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