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Analysis of Nonlinear Pulse Propagation Characteristics in Semiconductor Optical Amplifier for Different Input Pulse Shapes

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Abstract : This paper presents nonlinear pulse propagation characteristics for different input optical pulse shapes with various input pulse energy levels in semiconductor optical amplifiers. For simulation of nonlinear pulse propagation, finite-difference beam propagation method is used to solve the nonlinear Schrödinger equation. In this equation, gain spectrum dynamics, gain saturation are taken into account which depends on carrier depletion, carrier heating, spectral-hole burning, group velocity dispersion, self-phase modulation and two photon absorption. From this analysis, we obtained the output waveforms and spectra for different input pulse shapes as well as for different input energies. It shows clearly that the peak position of the output waveforms are shifted toward the leading edge which due to the gain saturation of the SOA for higher input pulse energies. We also analyzed and compared the normalized difference of full-width at half maximum for different input pulse shapes in the SOA.

Keywords : finite-difference beam propagation method, pulse shape, pulse propagation, semiconductor optical amplifier
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