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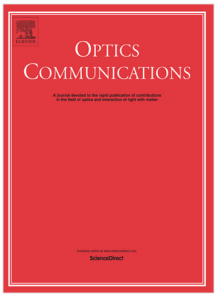

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Averaged-dispersion management for ultrashort soliton molecule propagation in lossy fibre systems

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Abstract

In this study we successfully designed ultrashort soliton molecules, required for ultra-high-speed fibre transmission systems, by means of average dispersion management in the presence of losses and periodic amplification. We also conducted a systematic numerical investigation of the individual and combined impacts of third-order dispersion, self-steepening and stimulated Raman scattering on the behaviour of two- and three-soliton molecules in the femtosecond regime, in particular, with respect to the breathing factor. We show that all the considered higher-order effects substantially hinder the propagation of soliton molecules. Finally, we suggest that optimal third-order dispersion compensation, combined with a correct choice of the breathing factor, may allow reduction of the penalties due to self-steepening and stimulated Raman scattering.

Keywords: Optical fibres, Soliton molecules, Average-dispersion management, Nonlinear Schrödinger equation, Higher-order effects

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1. Introduction

Bound states of solitons are quite common in optical fiber systems where they display a great variety of shape profiles (see for instance [1, 2, 3, 4]). Among this class of multi-soliton structures, soliton molecules (SMs) have received a particular attention since the first experimental evidence in dispersion-managed (DM) fibers [5], and the subsequent demonstration of their potential to expand the transmission capacity in optical communication systems [6, 7]. Research on SMs and their application in optical communications face numerous challenges. On the technological front, research activities

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