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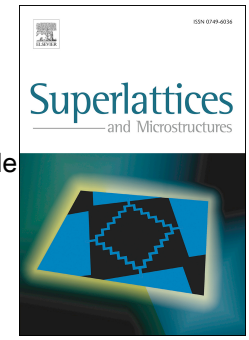

Stable optical soliton in the ring-cavity fiber system with carbon nanotube as saturable absorber

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Stable optical soliton in the ring-cavity fiber system with carbon nanotube as saturable absorber

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Abstract

Main attention focuses on the theoretical study of the ring-cavity fiber laser system with carbon nanotubes (CNT) as saturable absorber (SA). The system is modelled as a non-standard Schrödinger equation with the coefficients blended real and imaginary numbers. New stable exact soliton solution is constructed by the bilinear transformation method for the system. The influences of the key parameters related to CNTs and SA on the optical pulse soliton are discussed in simulation. The soliton amplitude and phase can be tuned by choosing suitable parameters.

Key words: ring-cavity fiber laser system; carbon nanotube; saturable absorber; non-standard Schrödinger equation; stable soliton solution; parameter influence

1. Introduction

Carbon materials possess unique geometrical structures, distinct photoelectric and photoconductive features with high optical nonlinearity and fast recovery time [1–6], so they can be as a class of excellent photoconductive fiber media, and have a promising application prospect in optical devices [7–12].

It is important to seek for high-performed saturable absorbers (SAs) with the properties of wavelength independent, high heat dissipation and high laser damage threshold in ultrafast photonics [13–19]. Nanoscale carbon materials have been used as SA in a mode-locked erbium-doped fiber laser (EDFL) for femtosecond or picosecond pulse generation [20–28]. Some recent advancements in fiber laser systems have brought about new insight to SAs. Carbon nanotubes (CNTs) have emerged as a novel technique for the fabrication of SAs [29–33]. In addition, many developments on fiber lasers have been focused on the use of CNTs with erbium (Er) fiber lasers to generate short optical pulse waves [34–38].

Most of previous researches about CNTs in ring-cavity fiber laser have been experimental so far. However, analytical study is fundamental because it may provide a deeper understanding on principle

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