Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **13 (2006)** 117-146

SOLITON-SOLITON INTERACTION WITH HAMILTONIAN PERTURBATIONS

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Abstract. The intra-channel collision of optical solitons, with non-Kerr law nonlinearities, is studied in this paper by the aid of quasi-particle theory. The Hamiltonian perturbations terms that are considered in this paper are third and fourth order dispersions, self-steepening, nonlinear dispersion and frequency separation. The suppression of soliton-soliton interaction, in presence of these perturbation terms, is acheived. The nonlinearities that are studied in this paper are Kerr, power, parabolic and dual-power laws. The numerical simulations support the quasi-particle theory.
AMS subject classification: 35Q51; 35Q55; 37K10; 78A60

1 Introduction

The theoretical possibility of existence of optical solitons in a dielectric dispersive fiber was first predicted by Hasegawa and Tappert [12]. A couple of years later Mollenauer et al [12] succesfully performed the famous experiment to verify this prediction. Important characterestic properties of these solitons are that they posses a localized waveform which remains intact upon interaction with another soliton. Because of their remarkable robustness, they attracted enormous interest in optical and telecommunication community. At present optical solitons are regarded as the natural data bits for transmission and processing of information in future, and an important alternative for the next generation of ultra high speed optical communication systems.

The fundamental mechanism of soliton formation namely the balanced interplay of linear group velocity dispersion (GVD) and nonlinearity induced self-phase modulation (SPM) is well understood. In the pico second regime, the nonlinear evolution equation that takes into account this interplay of GVD and SPM and which describes the dynamics of soliton is the well known nonlinear Schrödinger's equation (NLSE). The NLSE, which is the ideal equation in an ideal Kerr media, is in its original form found to be completely integrable by the method of Inverse Scattering Transform (IST) and