MODELING AND SIMULATION TO EXTEND FIBRE OPTIC COMMUNICATION SIGNAL TRANSMISSION USING MICRO RING RESONATOR

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To my: Dear

Father and Mother

Thanks for your supports and for all that you have done to me.

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ABSTRACT

Long-distance communication systems use high-bit-rate optical fibre, where dispersion and distortion of the signals cause technical difficulties and problems which have to be dealt with in order to optimize the efficiency and the reliability of such systems. Applying soliton transmission is an interesting method due mainly to its potential capability to overcome the effect of fibre dispersion and to provide all optical transmission systems. Optical solitons can be formed when a balance has been established between self-phase modulation and group velocity dispersion within the regime of anomalous dispersion. The consequent governing wave equation is of the nonlinear Schrodinger (NLS) type. In this thesis, a system of microring resonators (MRRs) connected to an optical modified add/drop filter is presented as a soliton pulse generator. The system uses chaotic signals generated by a Gaussian laser pulse and bright soliton propagating inside a nonlinear MRR system. The chaotic signals can be generated via a set of microring resonators, suitable for long distance communications. The obtained results show comparison of laser and generated solitonic signals over several distances. Then, the generation of solitonic signals using add/drop filter system connected to a series of micro ring resonators is demonstrated and the output of this model is compared to various disposition of the Bit Error Rate (BER) for soliton versus laser signals over 25, 50 and 100 Km distances. Thus, these types of signals can be used in optical indoor systems such as wireless personal area networks and transmission link using appropriate components such as transmitter, fibre optics, amplifier, and receiver.

ABSTRAK

Sistem komunikasi jarak jauh menggunakan gentian optik halaju-tinggi, dimana isyarat penyebaran dan herotan yang menyebabkan masalah teknikal, memerlukan perhatian untuk memastikan kecekapan dan kebolehpercayaan suatu sistem pada tahap optimum. Penggunaan transmisi soliton pada sistem adalah satu kaedah yang menarik, disebabkan oleh kebolehan ia untuk mengatasi masalah sebaran isyarat gentian opti dan juga berkemampuan untuk keseluruhan sistem transmisi. Soliton optikal boleh terbentuk apabila keseimbangan di antara modulasi kendiri dan halaju sebaran berada pada kawasan sebaran ganjil terjadi. Natijah ini adalah berkaitan dengan persamaan gelombang jenis Schodinger tidak linear (NSL). Di dalam tesis ini, satu sistem resonator mikro (MRRs) disambungkan pada gentian optik yang telah diubahsuai sebagai penapis tambah/jatuh sebagai penjana denyut soliton. Sistem ini menggunakan janaan isyarat huru-hara oleh denyut laser Gaussian dan sinaran soliton terbiak di dalam sistem resonator mikro tidak-linear. Isyarat huru-hara ini terbentuk melalui set resonator mikro, yang sesuai dengan pengunaan komunikasi jarak jauh. Keputusan yang diperoleh menunjukkan perbandingan antara isyarat laser dengan isyarat solitonik pada jarak yang berbeza. Kemudian, isyarat generasi solitonik menggunakan sistem penapis tambah/jatuh disambungkan pada cecincin resonator mikro dihasilkan dan natijah dari model ini dibandingkan antara Kadar Ralat Bit (BER) yang berbeza dengan pancaran laser melebihi jarak 25, 50 dan 100 km. Justeru, isyarat jenis ini boleh digunakan pada sistem optikal tertutup seperti rangkaian kawasan sulit tanpa wayar and jaringan transmisi menggunakan komponon sewajarnya seperti pemancar, gentian optik, penguat dan penerima.