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HIGHER ORDER GABITOV-TURITSYN EQUATION FOR DISPERSION-MANAGED VECTOR SOLITONS

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Abstract. The higher order multiple-scale asymptotic analysis is carried out for the Gabitov-Turitsyn equation that governs the propagation of dispersion-managed solitons through birefringent fibers as well as multiple channels. The averaged equation, with the higher order terms, considerably improves the description of the soliton characterestics in such fibers.

AMS subject classification. 35Q51; 35Q55; 37K10; 78A60

1 INTRODUCTION

The propagation of solitons through optical fibers has been a major area of research given its potential applicability in all optical communication systems. The field of telecommunications has undergone a substantial evolution in the last couple of decades due to the impressive progress in the development of optical fibers, optical amplifiers as well as transmitters and receivers. In a modern optical communication system, the transmission link is composed of optical fibers and amplifiers that replace the electrical regenerators. But the amplifiers introduce some noise and signal distortion that limit the system capacity. Presently the optical systems that show the best characterestics in terms of simplicity, cost and robustness against the degrading effects of a link are those based on intensity modulation with direct detection (IM-DD). Conventional IM-DD systems are based on non-return-to-zero (NRZ) format, but for transmission at higher data rate the return-to-zero (RZ) format is preferred. When the data rate is quite high, soliton transmission can be used. It allows the exploitation of the fiber capacity much more, but the NRZ signals offer very high potential especially in terms of simplicity [9].

There are limitations, however, on the performance of optical system due to several effects that are present in optical fibers and amplifiers. Signal propagation through optical fibers can be affected by group velocity dispersion (GVD), polarization mode dispersion (PMD) and the nonlinear effects.