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Variational method to spatial soliton propagation in a waveguide with periodic parabolic index profile

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Abstract

In this paper, we study spatial soliton propagation in a waveguide with periodic parabolic refractive index profile. Wave equation in the present of the refractive index profile includes diffraction, self-focusing (SF) and self-defocusing (SDF). To solve the wave equation, we use variational method and finally discuss the effect of self-defocusing and maximum potential depth on soliton behaviour.

Keywords: spatial soliton propagation, waveguide, variational approach, self-focusing, self-defocusing, Romberg's method

1. introduction

A parallel beam of light with a diameter d will usually expand with an angle of $\frac{\lambda}{d}$ due to diffraction [1]. In 1964, Chiao, Garmire, and Townes [2, 3] demonstrated that the expansion of an optical beam can be prevented in a nonlinear optical medium. We assumed a medium with intensity-dependent index of refraction, in which the index increases with the light intensity. In such a medium, refractive guiding can occur, because the beam can create a waveguide for itself, in which the index of refraction will be greater at the center of the beam than in its wings [1]. Then the light in this self-formed waveguide can prop-

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