STRUCTURE DEPENDENT VARIATIONS OF GROUP VELOCITY, ENERGY LOSS AND CONFINEMENT IN A REGULAR GRATTED WAVEGUIDE

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The Green’s function method in the Dyson’s formulation has been employed for the ab initio numerical study of structural effects on the device performances in terms of the minimum group velocity, energy loss and energy confinement in a quasi two-dimensional grated waveguide device model. The structure parameters to be varied in this work consist of the number of the grating teeth (N) and the grating groove depth (g). It is found that those parameters exhibit roughly linear and mostly monotonous variations at the lower resonance. The reduction of the group velocity and enhancement of energy confinement are also shown to be effectively attained by increasing N, while leaving the loss parameter relatively unaffected. On the other hand, the calculated results for the upper resonance wavelength are shown to exhibit consistently non-monotonous responses to increasing g. Similarly distinct behaviors are also found in the relationship between the minimum group velocity (vg,min) and the energy loss (L) as well as that between vg,min and the confined energy (W) for various N and g at the upper resonances. This peculiarly different behaviors are shown to be related to the variations of the associated local density of states with respect to N and g calculated for the upper resonance.

Keywords: Green’s function method; grated waveguide; group velocity; energy loss; confinement.

1. Introduction

The intensive world wide researches on photonic crystal (PhC) performed in the last three decades have clearly shown that with its rich structural variety, this artificial system has emerged as one of the most promising platforms for photonic devices offering a host of enhanced and novel functionalities in the manipulation of

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