Modeling of Racetrack Resonator with Grating Assisted Coupling

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We study the properties of Grating Assisted Couplers (GACs) included in a racetrack resonator geometry. A more detailed theoretical model of the coupling than is usually performed is shown to be necessary to describe correctly the behaviour of devices fabricated in SOI.

Introduction

The GAC is an optical component successfully applied in integrated optics ($LiNbO_3$) [1] and fibre optics [2]. Recently, it has been used in SOI to demonstrate channel dropping with dispersion control, with devices as long as 100 μm [3]. In order to reduce the device length and retain high selectivity, we have arranged it into a racetrack resonant cavity, thus obtaining a novel device. Such a device can be functional for add-drop behavior of a limited set of channels in DWDM systems.

Results

Using the simplified Coupled Mode Theory and the transfer matrix approach implemented by ASPIC modeling software [4], the inclusion of the GAC into the racetrack geometry limits the frequency range over which the resonance occurs (Fig.1). Characterization of devices fabricated in SOI having grating regions made by sinusoidal sidewall modulation shows an overall similarity to the simulated behavior, but also discrepancies that the model cannot encompass, such as coupling of the isolated port and split resonance peaks. In this paper, we shall show that correct device modeling requires accurate description of the modal coupling within the GACs. The hypotheses of weak coupling and weak perturbation of the high confinement modal regime will be progressively released and discussed in relation to the accurate modeling of the racetrack resonance.

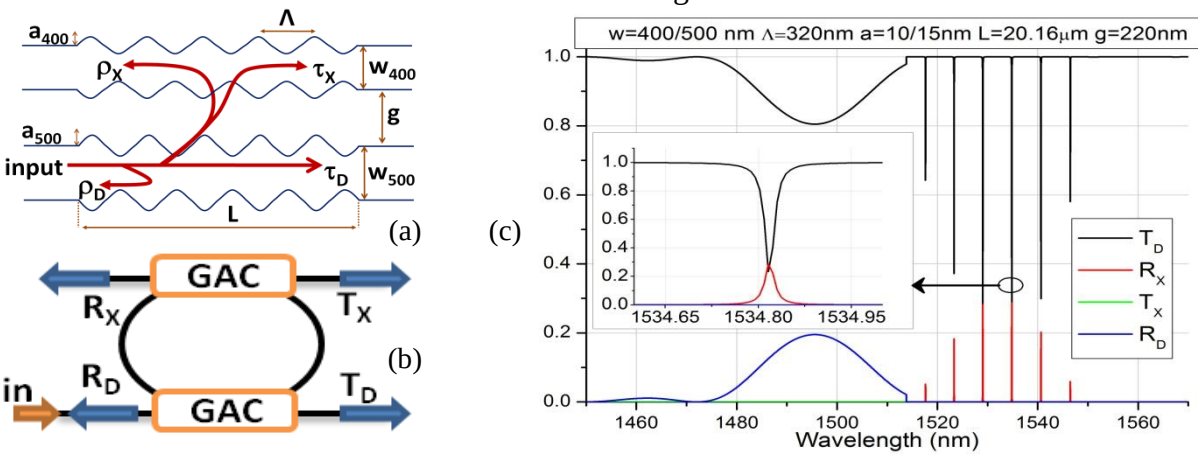

Fig.1 (a) GAC schematic. (b) Schematic of GAC in racetrack geometry and (c) its simulated behavior.

References

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