Design of Three-Branch Power Divider with a Low-Index Trapezoidal Microprism

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Abstract- *Design of low-loss power divider with a trapezoidal microprism of low index is proposed. The input power can be divided into three equal ones at output waveguides for large branching angles. The total transmitted power is as high as 97.7% for a branching angle of 4°, which is greater than that reported (88%). Moreover, by only varying the refractive index of the microprism, the powers entering the central and the side branches can be adjusted to a desired ratio.*

Optical power divider with multibranch is an essential element in optical communication. The size of conventional 1×N power divider constructed by linking two-branch (1×2) power divider will become large when N is increased. Therefore, dividing structure such as 1×3 is proposed as basic unit to build 1×N power divider. For 1×3 branching waveguide, Lin *et al.* [1] used two high index microprisms to modify the phase front of the input field to help the wave diverging at large branching angles. In this paper, a low index microprism in trapezoidal shape as shown in Fig. 1 is proposed. The dependence of the output power on the microprism refractive index n_p for the branching angle θ = 4° is shown in Fig. 2. By choosing an adequate n_p, the output power ratio between the central and the side branches can be equal to one or certain predetermined ratio, yet the total output power is still at a satisfactory transmission efficiency. As can be seen from Fig. 2, the transmitted powers of the central and side branch are 32.48% and 32.61%, respectively when θ = 4° and n_p= 1.4939. Thus, the transmission efficiency of 97.7% at θ = 4°is greatly higher than that reported (88%) [1]. Such a high transmitted power is attributed to the fact that both phase front and modal field in the proposed three-branch waveguide are carefully considered. Details of the application in optical integrated devices are of great interests in future.

[1] H. B. Lin, Y. H. Wang, and W. S. Wang, "Single-mode 1×3 integrated optical branching circuit design using microprism," *Electron. Lett.*, **30**, pp. 408-409 (1994).

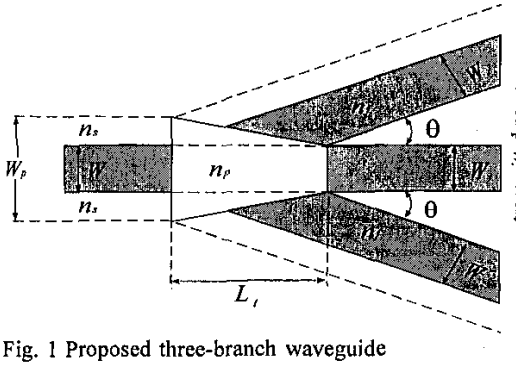

Fig. 1 Proposed three-branch waveguide

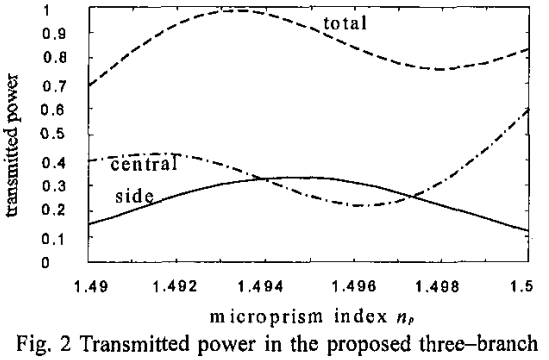

Fig. 2 Transmitted power in the proposed three-branch waveguide as a function of microprism index for θ = 4°

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