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Microphotonics

CAD-LAB: WAVEGUIDES

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Contents

1 Reducing the 3D structure to 2D: the effective index method

1.1

By simulating the slab waveguide modes, we get the fundamental TE-mode with,

$$n_{core} = 2.855119 \tag{1}$$

Comparing those modes, we find the least transmission when

$$n_{cladding} = 1.527117 \tag{2}$$

1.2

From the bent_coupler we get $\beta = 2.60528$

1.3 Observation

Fundamental mode: As Figure 1 shown, the results are almost the same in the center of the core. But the boudary shows the different effects. The actual TE-mode exists one small peak each side, but the slab-mode not.

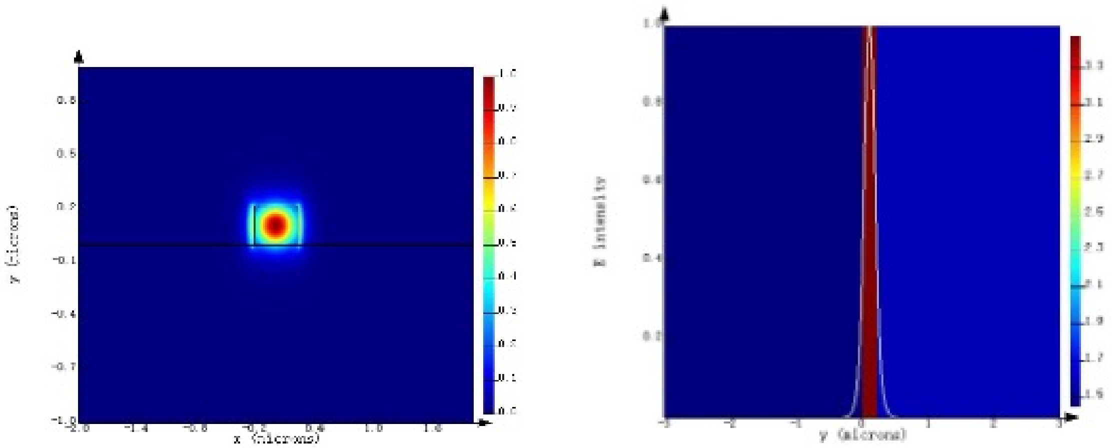

Figure 1: Fundamental mode: actual TE-mode (left); 2D slab TE-mode (right)

Modes on the two interface: They show a quite similar results in Fig 2.

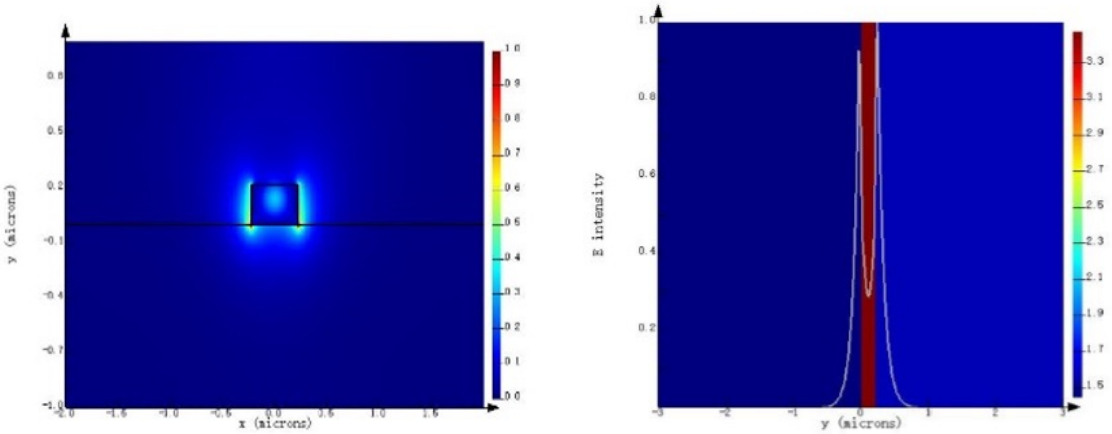

Figure 2: Mode on interface: actual TE-mode (left); 2D slab TE-mode (right)

Other modes: It is difficult to find some similarities among them. **The validity of the effective index method:** It is available when studing the fundamental mode of the center (or ignoring the boundary effect), or studying the interface mode.

2 Waveguide-ring coupler

2.1

The Fig 3 shows how the light propagates through the coupler and partly couples to the bent waveguide.

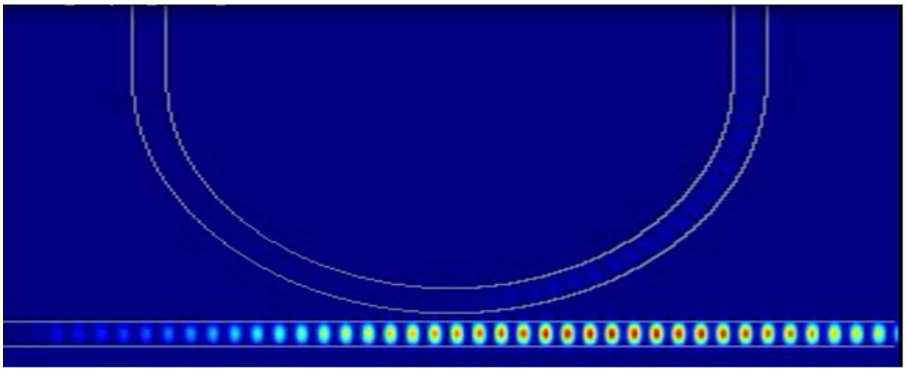

Figure 3: Here to write the caption of the figure.

2.2

With a continuous wave input, the behavior of the splitter is shown in figure 4. The first row is linear, and the second row is the logarithmic. It is obvious that the coupler is not very wavelength-dependent.

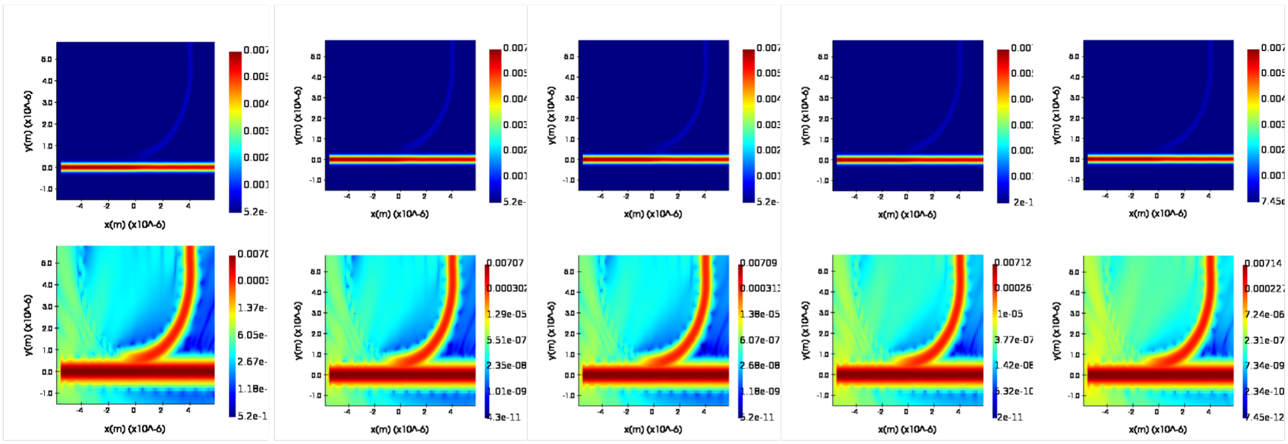

Figure 4: Here to write the caption of the figure.

2.3

Fig 5 shows the trasmission factor r, rises at three different ring-radius as the gap distance increases. The changing trend of them are similar as r and gap distance is positively correlated. It can be seen that r and gap-distance is linear positive correlation.

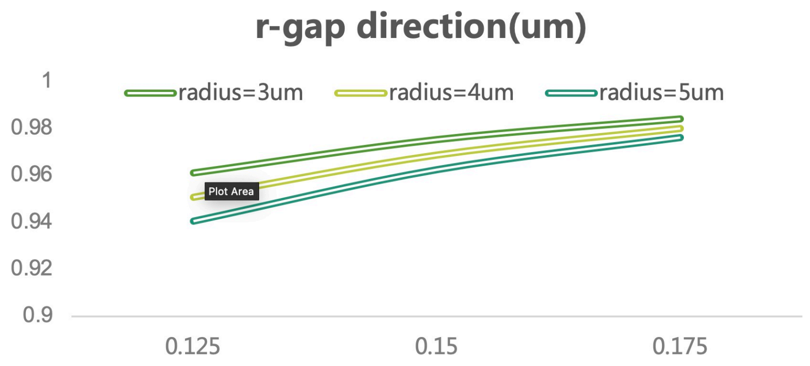

Figure 5: Here to write the caption of the figure.

3 Add-drop filter

3.1

There is three λ_{res}, $1569.32\mathrm{nm}$, $1538.01\mathrm{nm}$ and $1507.83\mathrm{nm}$, which is related to the T distribution of dft_wg_output. The average FSR of two initial FSR is $30.745\mathrm{nm}$, with

$$\mathrm{FSR} = \frac{\lambda^2}{n_g L}, n_g = 3.109 \tag{3}$$

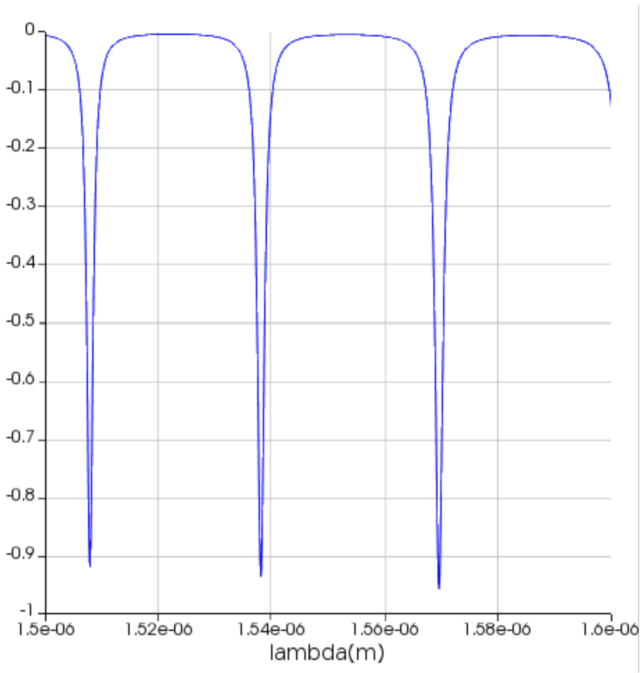

Figure 6: Here to write the caption of the figure.

3.2

When educing the waveguide range to $[1530\mathrm{nm}, 1550\mathrm{nm}]$, T distribution of dft_wg_output is shown in Fig 7, $\lambda_{res} = 1538.03\mathrm{nm}$. T of dft_wg_output in bend_coupler.fsp at λ_{res} is 0.905347. For $n_g = 3.109$, the FWHM can be calculated by

$$\mathrm{FWHM} = \frac{\left(1 - r^2\right) \lambda^2 res}{\pi n g L r} \tag{4}$$

and finally we get $FWHM = 958.6\mathrm{nm}$.

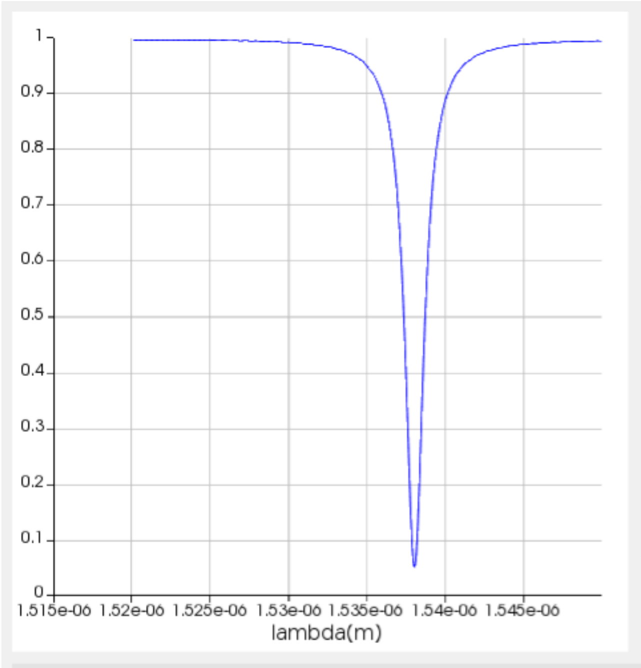

Figure 7: Here to write the caption of the figure.

3.3