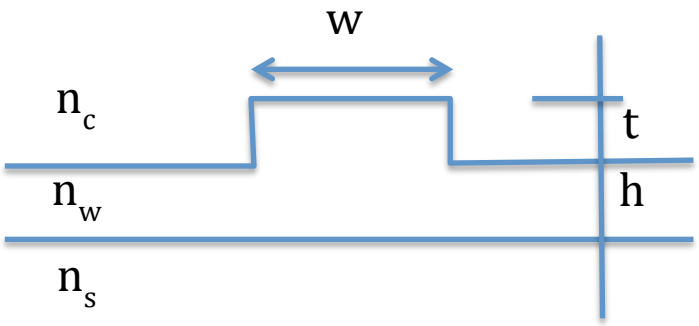
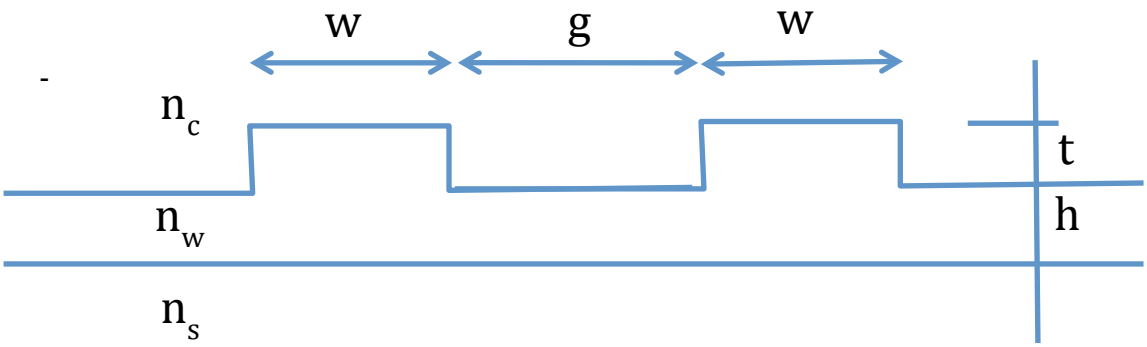
PHOTONIC DEVICE Course – Waveguides Exercise

Prof. Andrea Melloni, 2014-2015

Scope of this exercise is to help the student to acquire some expertise on mode calculation of dielectric waveguides and other simple properties of optical waveguides.
The modes can be calculated by using the Modesolver available on the website.
Suggested structures are shown below. Choose a waveguide or coupled waveguides as preferred. Use refractive indexes in the suggested ranges.





SiO2: 1.44…..1.46
SiON: 1.49…… 1.8
Silicon: 3.4…….3.55
For buried waveguides h=0

Polymer: 1.3…….1.6
Si3N4: 1.99…..2.3
InP: 3.2…….3.4

Design the waveguide and determine the characteristics. Suggested analysis and parameters are listed below:

- Single mode (bi-modal) condition;
- Shape of the field components for both TE and TM;
- Effective index (n_{eff});
- Group index (n_g);
- Phase and group birefringence
- Chromatic dispersion ($\beta(\lambda)$);
- Fiber to waveguide coupling efficiency (η);
- Hybridness;
- Dependence of the above parameters on geometrical dimensions, wavelength, temperature
- Mode size (x and y) vs w

For the directional coupler, proceed as above on both even and odd mode and calculated the Field Coupling coefficient k and its dependence on geometrical parameters. Verify the value with the definition of k.