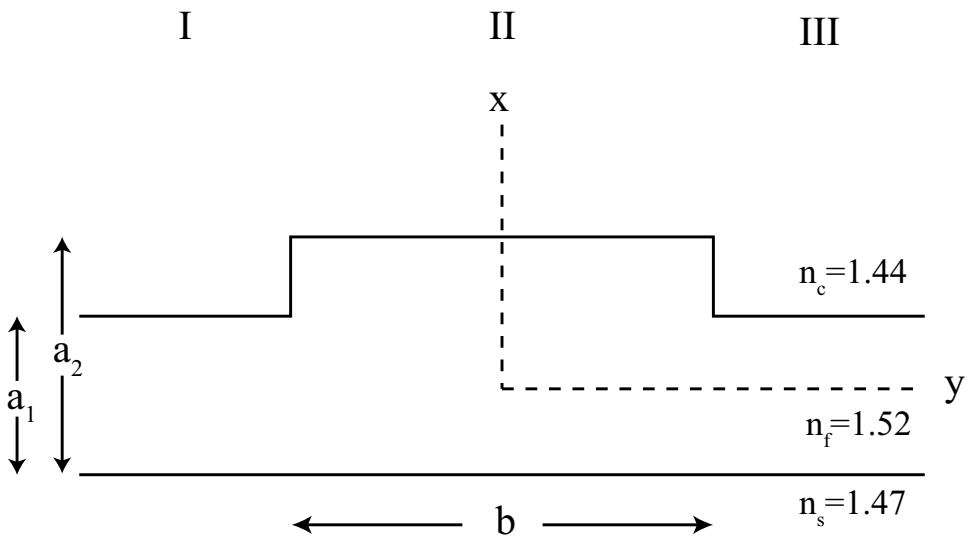
ECE 6440 - Photonic Microsystems
Laboratory I Spring 2011

In this laboratory assignment, you'll be working with a commercial integrated optics simulation package by Optiwave. This package has capabilities including a mode solver, beam propagation, and finite-difference time domain simulation. You'll use these aspects in the lab.

I won't require lab books, but I do want to see a short report from each of you describing what you did and your results and interpretations.

Part I - Mode solving

a) Use the Optiwave mode solver to solve for the mode(s) of the following ridge waveguide. Use a wavelength $\lambda = 1.0$ μm. Compare these results with your own calculations, including mode shape(s).



b) Do the same if, instead, the waveguide has the following parameters: $n_f = 3.5$, $n_c = n_s = 1.44$, $a_1 = 0.5$ μm, $a_2 = 0.7$ μm, $b = 1.0$ μm, and $\lambda_f = 1.55$ μm. Is there a slab mode too?

c) Finally, solve for the mode(s) of a Si "photonic wire" waveguide, which is a Si core waveguide ($n_f = 3.5$) sitting on top of an SiO_2 substrate and surrounded by air on the remaining three sides. Use a wavelength of $\lambda_f = 1.55$ μm and a square waveguide cross-section of 0.5 μm$\times$0.5 μm.

Part II - Beam propagation

a) Using both Si waveguides from Part I, design and simulate a directional coupler in which 50% of the power is transferred to the second waveguide. Note, this requires two designs, each design using identical waveguides.

b) Using one of your designs from part a), design and simulate a Mach-Zehnder interferometer.

Part III - FDTD

Using the photonic wire waveguide, deisgn and simulate a micro-ring resonator circuit and analyze its properties.