Lab #3 – 3D FDTD Simulation of Directional Couplers in MRRs – 100 points.

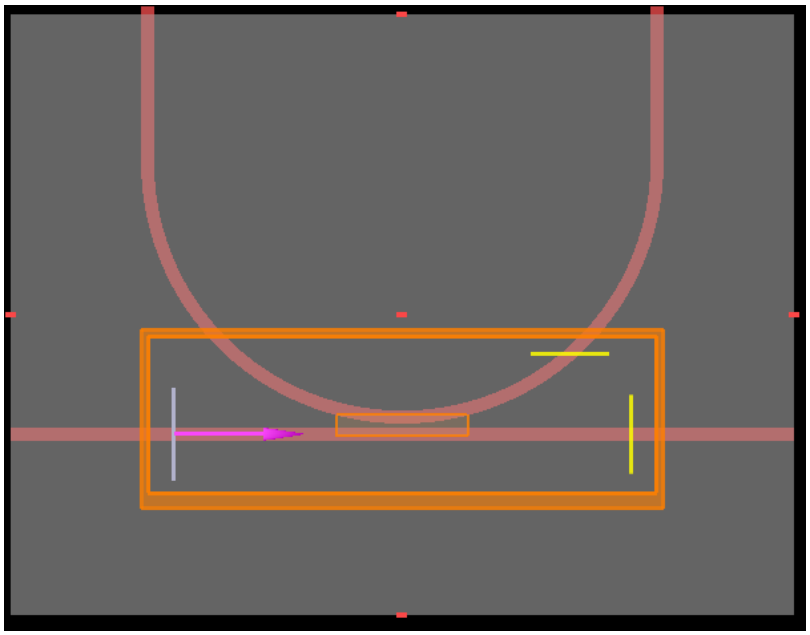
Submission Link: **https://www.dropbox.com/request/yfpA2ZfaFbzK5kUtySfT**

Due: October 15, 2018 at 18:00 (submission link will be deactivated after 18:00).

Please upload a zip file including your simulation files from Lumerical tools, results (export data), and a lab report. What should be included in the lab report? Summary of your approach (how the simulation works, explanation of different objects and sources in your simulation) and your approach, as well as all the results and plots from the simulations below.

Tutorial on Lumerical Scripting: https://kb.lumerical.com/en/ref_scripts_scripting_language.html

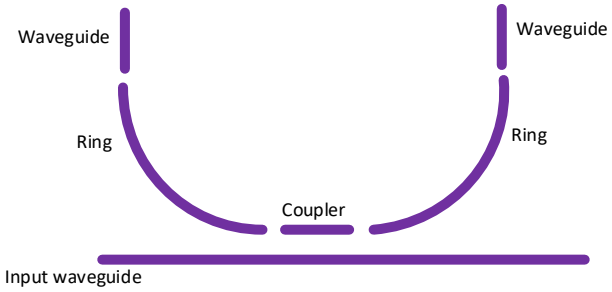
Lab description: We would like to design a polarization-dependent MRR. In this MRR, depending on the polarization of the light in the input (i.e., TE or TM), the coupling between the input waveguide and the ring varies. In other words, we like to find the *gap* between the input waveguide and the ring resonator that gives us a high coupling efficiency for the TE polarized light, and low coupling efficiency for the TM polarized light (or the other way around). This structure is helpful to study variations in MRRs (week 12). You need to have *two* separate FDTD simulation projects (the input light source in each one is different, one is TE polarized, and one is TM polarized).



A snapshot of Numerical FDTD for this simulation.

What do you need to consider?

You need to have a light source (TE or TM), simulation region, mesh, and some monitors (on the ring and on the through port, see the Figure above). The structure is similar to the one below:



Your simulation should accept the following parameters in the input (script). The user should be able to change these parameters in the input. Note that the location of your monitors, simulation region, etc. should be dynamically updated depending on any changes in the parameters below. For the mode source (on the input waveguide), choose the fundamental TE/TM mode and choose 1550 nm as central frequency under Frequency/Wavelength tab.

Parameter	Description	Default value
rds*	Ring radius	9.75 micron
in_wdth	Input waveguide width	500 nm
rng_wdth	Ring waveguide width	500 nm
thickness	SOI thickness (input waveguide and ring)	220 nm
mesh_size	Mesh size for FDTD simulations	dx =30 nm, dy=30 nm, dz=40 nm
cpl_length	Coupler length between MRR and input waveguide	4 micron
gap_range	The range of the gap we would like to try (edge to edge)	100 to 400 nm. 50 nm steps. [100, 150, 200, 250, 300, 350, 400]

* you should work with inner and outer radius in Lumerical which both depend on the width as well.

Output: Export the data for each simulations (save the data for other lab assignments**).** In the output, you should plot eight graphs: four with *cpl_length=4 micron* and four with *cpl_length=0*. The graphs should show the cross-over coupling (kappa) and straight-through coupling (t/s) in the ring (y-axis) vs. gap (in nm, x-axis) for both TE and TM polarizations (different figures).