














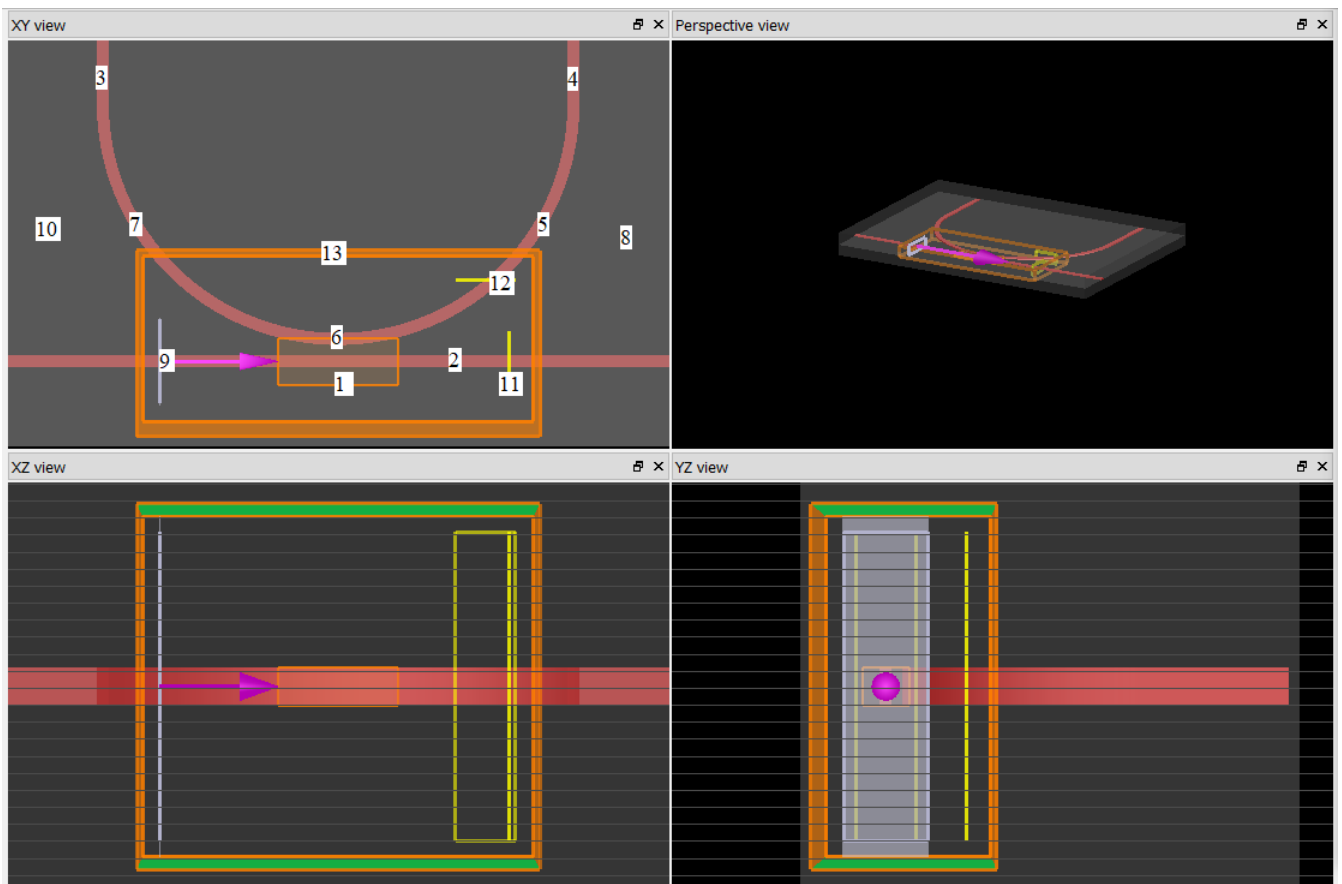
## ECE 560B6 Lab 3 Report

### Objective:

To design a polarization-Dependent MRR and perform 3D FDTD simulation of directional couplers in MRRs.

### Objects used:

	mesh	Mesh	1
	Input_waveguide	Rectangle	2
	Left_waveguide	Rectangle	3
	Right_waveguide	Rectangle	4
	Right_ring	Ring	5
	Coupler	Rectangle	6
	Left_ring	Ring	7
	Oxide	Rectangle	8
	simulation_port2	ModeSource	10
	Cladding	Rectangle	11
	ThroughPort	DFTMonitor	12
	DropPort	DFTMonitor	13
	FDTD	FDTD	14



### Approach:

My script accepts all the parameters mentioned in the description:

Parameter	Description	Default value
<b>radius</b>	Ring radius	9.75 micron
<b>wg_width</b>	Input waveguide width	500 nm
<b>ring_wdth</b>	Ring waveguide width	500 nm
<b>thickness</b>	SOI thickness (input waveguide and ring)	220 nm
<b>mesh_size</b>	Mesh size for FDTD simulations	dx =30 nm, dy=30 nm, dz=40 nm
<b>cplr_length</b>	Coupler length between MRR and input waveguide	4 micron
<b>gap</b>	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]

Over the past few weeks, I performed a few simulations changing different variables and marked the changes in coordinates in each object in the object tree. Then I analyzed these changes and constructed mathematical equations for changes in each object for the respective change in each parameter. The script was done with the help of tutorials provided by the Lumerical website and the scripts used in previous labs. Waveforms were achieved for all the combinations of gaps and coupler lengths and have been provided below. The script and the executables are provided in the zip file.

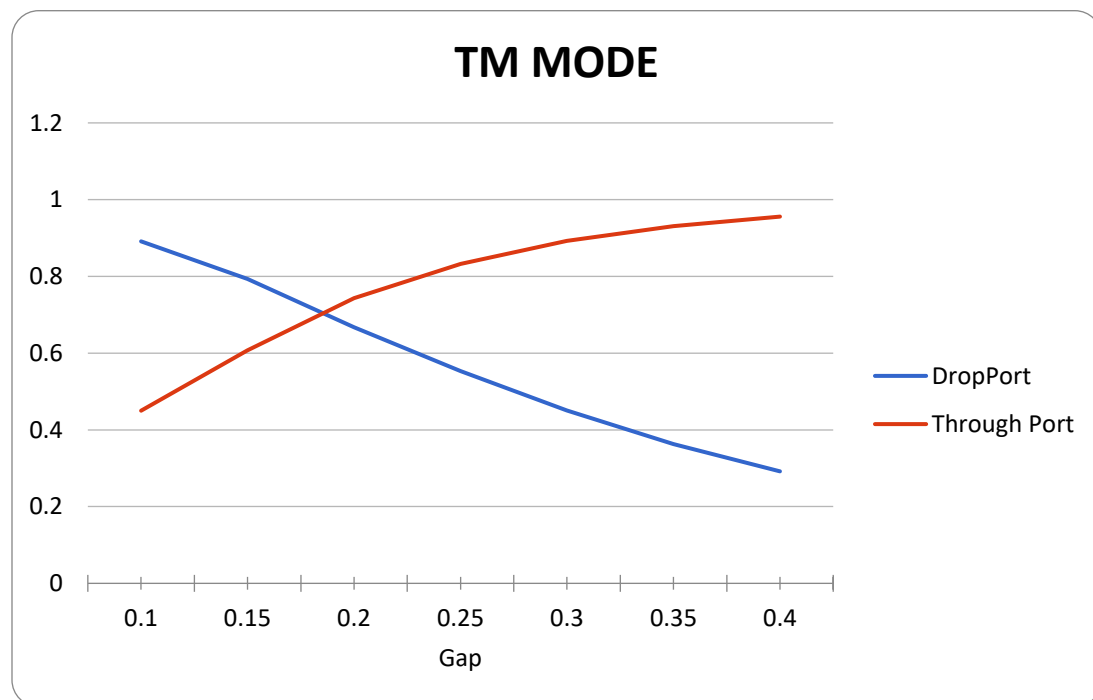
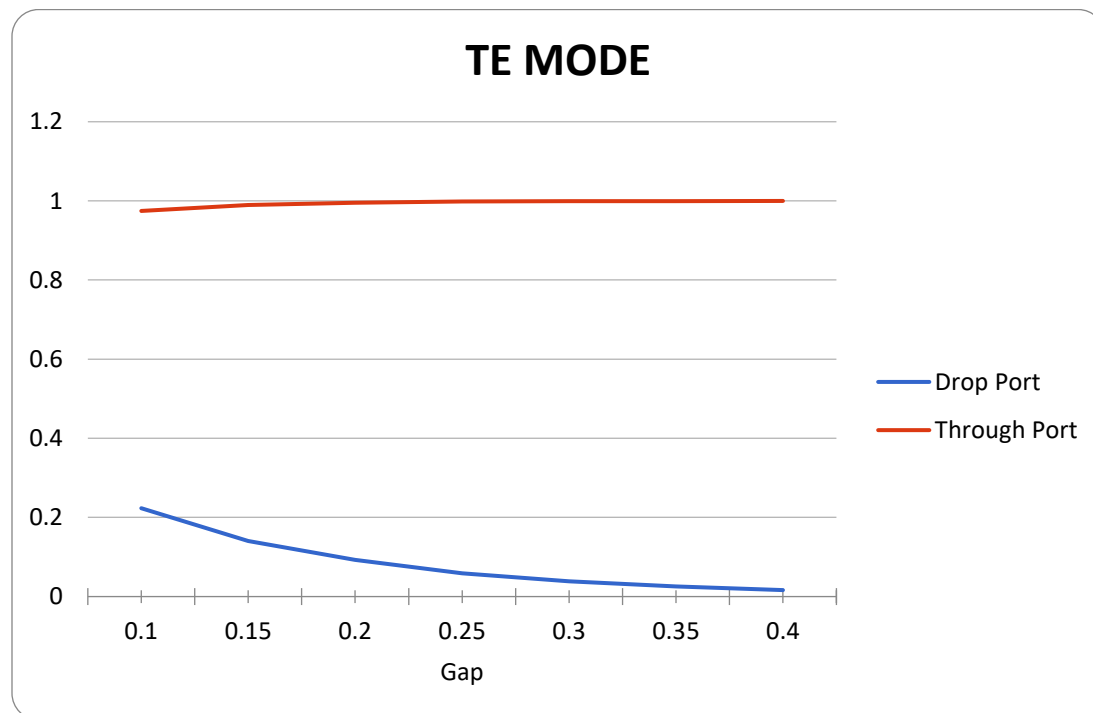
### Output:

Coupler length =0	TM mode				
	Gap	Drop port	Through port	SQRT (Drop Port)	SQRT (Through Port)
	0.1	0.794361	0.202449	0.8912693196	0.4499433298
	0.15	0.628928	0.36862	0.7930498093	0.6071408403
	0.2	0.445783	0.552427	0.6676698286	0.7432543306
	0.25	0.305637	0.69281	0.5528444628	0.832352089
	0.3	0.202673	0.795919	0.4501921812	0.8921429258
	0.35	0.131865	0.866776	0.3631322073	0.9310080558
	0.4	0.0851848	0.913513	0.2918643521	0.9557787401

Coupler Length = 0	TE mode				
	Gap	Drop port	Through port	SQRT (Drop Port)	SQRT (Through Port)
	0.1	0.0498692	0.949782	0.2233141285	0.9745675964
	0.15	0.0198348	0.980007	0.1408360749	0.9899530292
	0.2	0.00860185	0.991316	0.09274615895	0.9956485324
	0.25	0.00346002	0.996492	0.05882193468	0.998244459
	0.3	0.00148067	0.9985	0.03847947505	0.9992497185
	0.35	0.00064321	0.999346	0.02536158512	0.9996729465
	0.4	0.000268151	0.999717	0.01637531679	0.99985849

Coupler Length = 4um	TE mode				
	Gap	Drop port	Through port	SQRT (Drop Port)	SQRT (Through Port)
	0.1	0.276355	0.722374	0.5256947784	0.8499258791
	0.15	0.118082	0.881389	0.3436306156	0.9388231995
	0.2	0.0520025	0.947796	0.2280405666	0.9735481498
	0.25	0.0210448	0.978828	0.1450682598	0.9893573672
	0.3	0.0089633	0.990961	0.09467470623	0.9954702406
	0.35	0.00388617	0.99608	0.06233915303	0.9980380754
	0.4	0.00162961	0.998351	0.04036842826	0.9991751598
	TM mode				
	Gap	Drop port	Through port	SQRT (Drop Port)	SQRT (Through Port)
	0.1	0.278455	0.715618	0.527688355	0.8459420784
	0.15	0.770933	0.220737	0.8780279039	0.4698265637
	0.2	0.930789	0.114593	0.9647740668	0.3385158785
	0.25	0.851284	0.175598	0.9226505297	0.4190441504
	0.3	0.66723	0.349478	0.8168414779	0.5911666432
	0.35	0.479077	0.528299	0.6921538846	0.7268417985
	0.4	0.328649	0.674005	0.5732791641	0.8209780752

## Coupler Length = 0



**Coupler Length = 4um**

