

Report Body

Introduction

Interferometers – why

- Use as a multiplexer/demultiplexer
- Basic concept – wavelength-dependent phase shift due to length difference
- Ideally sinusoidal transfer function – can control scale (25 GHz) but not phase

Model and theory

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Design methodology

- Few parameters
 - o Waveguide width
 - Consider the process bias of -15 nm (objects are 15 nm narrower than intended)
 - Waveguides are all nominally 350 nm wide for compatibility with provided parts
 - Actual width is closer to 335 nm. Values near this are designed and simulated.
 - o Waveguide Height
 - Fabrication process fixes this at 220 nm, however manufacturing variance from 210-230 nm is considered
 - o The following waveguide parameters were each simulated in Lumerical MODE:

	simulated width	simulated height	wavelength	ng	delta L (mm)
MZI1-3	335	220	1310	4.490943	2.670196
MZI4_350	350	220	1310	4.443088	2.698956
	345	230	1310	4.459454	2.689051
	325	210	1310	4.514493	2.656267
MZI9_Shortest	325	210	1330	4.519458	2.653349
MZI7_Longest	345	230	1270	4.432688	2.705288
MZI5_HiFreq	335	220	1270	4.467645	2.684121
MZI6_LowFreq	335	220	1330	4.500646	2.664439

- o I included 8 devices on the board by using a compact vertical design
 - Three are identical and use the basic 335*220 nm waveguide
 - Multiple copies to account for manufacturing variability
 - The extremes of possible waveguide dimensions and the target wavelength band are used to get a upper and lower bounds on the appropriate path length difference, these are included as the last two designs

- I also included two designs which assume that the waveguide will have perfect dimensions besides the process bias, but are designed for the edges of the target 1270-1330 nm wavelength band
- There is also one where I simulated a 350x220 nm waveguide (not accounting for process bias) to see how differently it performs versus accounting for the bias

Simulation

- I'm out of time for the peer review but I did do an interconnect simulation of the base design. When I zoom in, I see a nice 25 GHz spacing:
- I know this document is very disorganized, feel free to reach out on Discord at rondnelson99 if you have questions!

