Aryan Chahardovalee – ELEC 413 – Semiconductor Lasers _ Project 2 Design document

Part 0: Introduction

In this project, each student's best optical resonator (designed in project 1) is used to create a single circuit where a commercially off-the-shelve laser will power all the resonators.

The approach taken in this project is to design a Fabry Perot Cavity resonator by sandwiching a waveguide between two equally-lengthed Bragg gratings. Simulations and calculations are done as part of project 1 to ensure that the cavity has a high quality factor. Please refer to Project 1's design document for more information.

As with Project 1, there is a bias to the fabrication process in process 2 where waveguides with a specified width of 350nm will be printed 315nm, which is 35nm smaller than the specified width. Because of this biassing effect the Fabry Perot Cavity in this project is designed for a width of 335nm and is drawn for fabrication at 370nm.

Table 1: Geometrical parameters summary

Name of Parameter	Value of Parameter	Type of Parameter
Width	Actual: 335 nm / fabricated: 370nm	Fixed parameter
Corrugation Width	30 nm	Fixed parameter
Thickness	220 nm	Fixed parameter
Bragg Number	103	Fixed parameter
Length of the Waveguide in between the Bragg Gratings	100 ɥm	Fixed parameter
Bragg Period	269 nm	Fixed parameter

Part 2: Fabrication

1. A single laser on-chip will power all the resonators on the circuit. A splitter tree will divide the light from the laser within all the resonators equally.

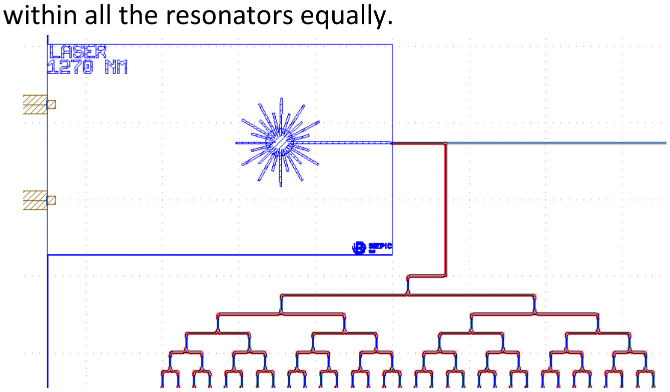

Figure 1: Input to ELEC 413 - Project 2 optical circuit

In relation to the python code our input will be the pin "opt1" of the inst_wg1.

2. Each student's design is comprised of a python script where the specifications of the Bragg grating, and the waveguide are defined. Also, pins are connected to each other using the

"connect_cell" command. A description of how the pins where connected in my model is given bellow:

```
# opt1<---inst_wg1--->opt2 + opt2<---cell_y--->opt1 = opt1<---inst_y1--->opt1

# opt1<---inst_y1--->opt1 + pin1<---cell_tapper--->pin2 = opt1<---inst_tapper1--->pin2

# opt1<---inst_tapper1--->pin2 + opt1<---cell_bragg--->opt2 = opt1<---inst_bragg1--->opt2

# opt1<---inst_bragg1--->opt2 + opt2<---cell_bragg--->opt1 = opt1<---inst_bragg2--->opt1

# opt1<---inst_bragg2--->opt1 + pin2<---cell_tapper--->pin1 = opt1<---inst_tapper2-->pin1
```

With respect to the python code the output of the waveguide corresponding to transmission output is "pin1" of the inst_tapper2. And the reflection output is pin "opt3" of the inst_y1 (not shown above). Inst_y1 describes the input and the y branch part of the circuit. The y branch is used to get information of reflectivity back to the detectors (detectors for reflectivity is connected to pin "opt3" of the inst_y1). A taper is incorporated between the y branch and the first Bragg grating so that we the width can be changed from the standard 350 nm wide to 370 nm wide. This tapper is instantiated twice for either side of the Bragg gratings.

3. Finally a long waveguide is added to the design. This waveguide has a width of 370 nm and is located between pin "opt2" of the inst_bragg1 and "opt2" of the inst_bragg2 instance.
4. Waveguides that connect everything else are to be specified by the instructor and are not part of the design parameters.

Part 3: Experimental Data and Analysis

To be performed after the fabrication.

Part 4: Discussion and Summary

To be performed after the fabrication.

Part 5: References

To be completed after the fabrication.