Kappa Analysis and Comparison Tool

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1 Introduction

This tool provides an open-source method of closely approximating the crossover and through-port coupling coefficients for microring resonators (MRRs). It is a python based tool and uses user input from a text file to specify waveguide geometry/parameters. It includes an optional plotting parameter, which allows the user to compare the coupling coefficients to FDTD simulated data for devices with radius of 10 μm and optical wavelength of 1550nm.

2 Setup and Installation

To install, first clone or download the repository from https://github.com/RGloekler/kappa_analysis.git and ensure that you have a current installation of Python 3 and pip. To install the program dependencies, run the following line in a terminal: *pip install -r requirements.txt*. This will automatically install the proper versions of numpy, matplotlib, etc. needed to run the tool.

3 Using the Tool

To use the tool, open a command line terminal in the kappa_analysis directory. The input parameters/geometry can be changed by editing the kappa_input.txt file. Note that to ensure high accuracy approximation, input radius should be within the range of 3 - 15µm. After the pre-requisites are installed, the program can be run like any other python script: *python3 kappa_analysis.py*. The program can also compare its analytical model results to coupling values from FDTD simulations run at 1550nm input wavelength with 10 μm radii. To do this, add the optional *-plotR10* flag to the end of the command, and a comparison plot will be generated. Note: this flag should only be used in the identical waveguide case, that is in_wdth == ring_wdth.

Non-Identical Input Waveguides: The tool also allows the user to compute and approximate kappa for non-identical waveguide pairs, where the ring waveguide is exclusively *larger* than the input waveguide.

DISCLAIMER: For non-identical waveguide width pairs, the input parameters are guaranteed to be accurate for input parameters (in_wdth,ring_wdth, gap) that are in steps of 50. Inputs that are out of this step size are rounded to the nearest step, and as such may have slightly lower kappa accuracy. However, the radius value can still be any value within the range of 3 - 15 µm.