

# TUTORIAL PROPOSAL

Tutorial Title: **Photonic Integrated Circuit Design: a comprehensive tutorial using Ansys Lumerical**

Presenter: **Nikhil Dhingra / Senior Application Engineer / Ansys**

Tutorial duration: **3 hours**

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## **MOTIVATION / NEED ANALYSIS**

Photonics industry is witnessing a rapid growth, with market expanding in new verticals including healthcare (sensing), automotive (HUD, LiDAR), quantum (computation and communication), consumer electronics (cameras, displays, AR/VR), and so on. Photonic Integrated circuits (PICs) are essential for most of these applications and hence their demand is more than ever. To fulfill these demands, the industry needs the following:

**“PIC designers, who are trained in industry leading simulation tools and a standardized workflow like EDA industry.”**

Hence, there is a need to work towards increasing awareness about the PIC technology and the relevant solutions for their designs. This can be done in two ways: **(a)** by introducing theory courses and setting up specific laboratories as part of academic curriculum, **(b)** by providing the relevant training from industry.

As part of the latter (b), we propose a tutorial on the design of photonic integrated circuits at Photonics 2023. As Photonics 2023 is one of the renowned conferences in photonics in India, many people can get benefited from this tutorial.

## **DESCRIPTION**

The tutorial explains the design process of photonic integrated circuits (PICs) from component-level simulation to circuit-level simulation using industry-leading tools offered by Ansys Lumerical. The tutorial starts with an introduction to optics and photonics and explains the interaction of light at different scales (nano to macro). Next, it provides a basic introduction to PICs and gives an overview of different simulation tools and techniques. Finally, through an instructor-led demo, it takes you through the entire design process of a ring modulator, which is one of the important components in most of the integrated photonic circuits.

## **INTENDED AUDIENCE**

Students, researchers, or engineers who are interested in learning about photonic integrated circuit design using industry-leading tools.

## OUTLINE / AGENDA OF THE TUTORIAL

- Introduction to Optics & Photonics ( $\approx 15$  minutes)
  - Interaction of light: from nanoscale to macroscale
  - Applications of photonics
- Photonic integrated devices and circuits ( $\approx 15$  minutes)
  - Introduction
  - Material platforms
- Overview of simulation tools: Ansys Lumerical ( $\approx 30$  minutes)
  - Component-level: MODE, FDTD, and Multiphysics
  - Compact model generation: Manual vs Automated (CML compiler)
  - Circuit-level: INTERCONNECT
- Break ( $\approx 15$  minutes)
- Instructor-led demo using Ansys Lumerical ( $\approx 90$  minutes)
  - Design and simulation of a ring modulator: component to circuit level (Fig. 1)
- Feedback and Q&A session ( $\approx 15$  minutes)

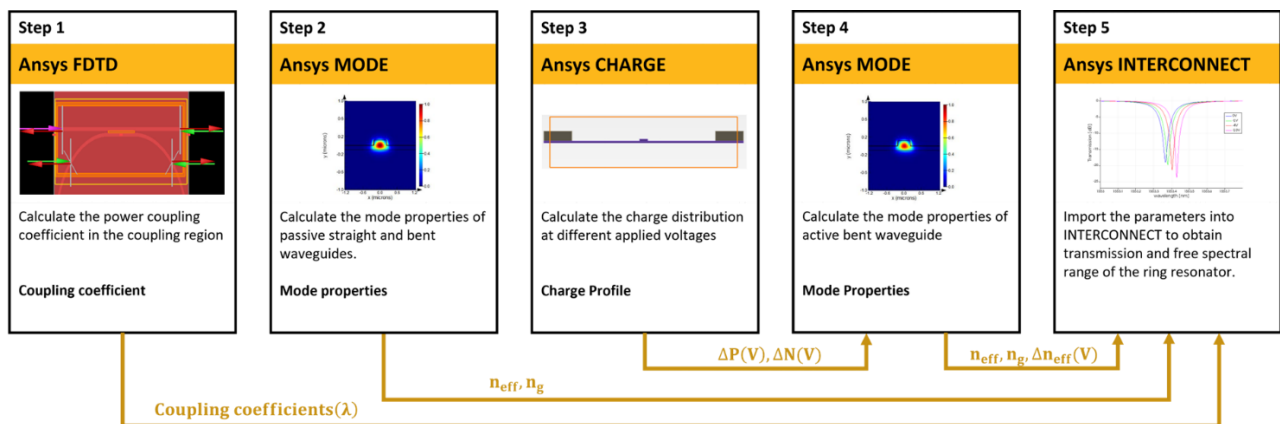


Fig 1. Design flow of ring resonator

## LEARNING OUTCOMES

The tutorial will enable the attendees to:

- describe the interaction of light at different scales
- tell the difference between different simulation tools offered by Ansys Lumerical
- gain an insight of the entire design process of PICs – component-level to circuit-level.
- understand the relevant skills required to become a PIC designer

## REFERENCES

<https://optics.ansys.com/hc/en-us>