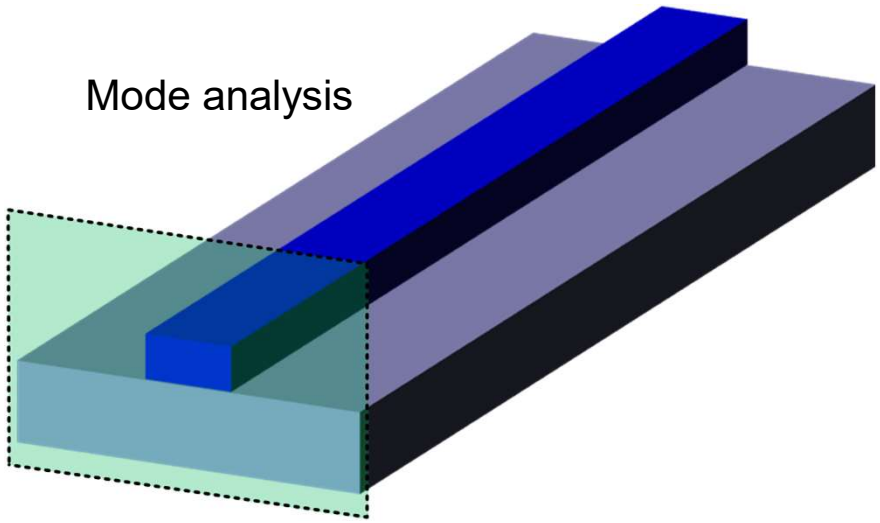
ETH zürich

P&S COMSOL® Design: Simulations of Optical Components Tutorial 4: Optical Waveguide I

Manuel Kohli, Tobias Blatter, Raphael Schwanninger

Waveguiding in COMSOL

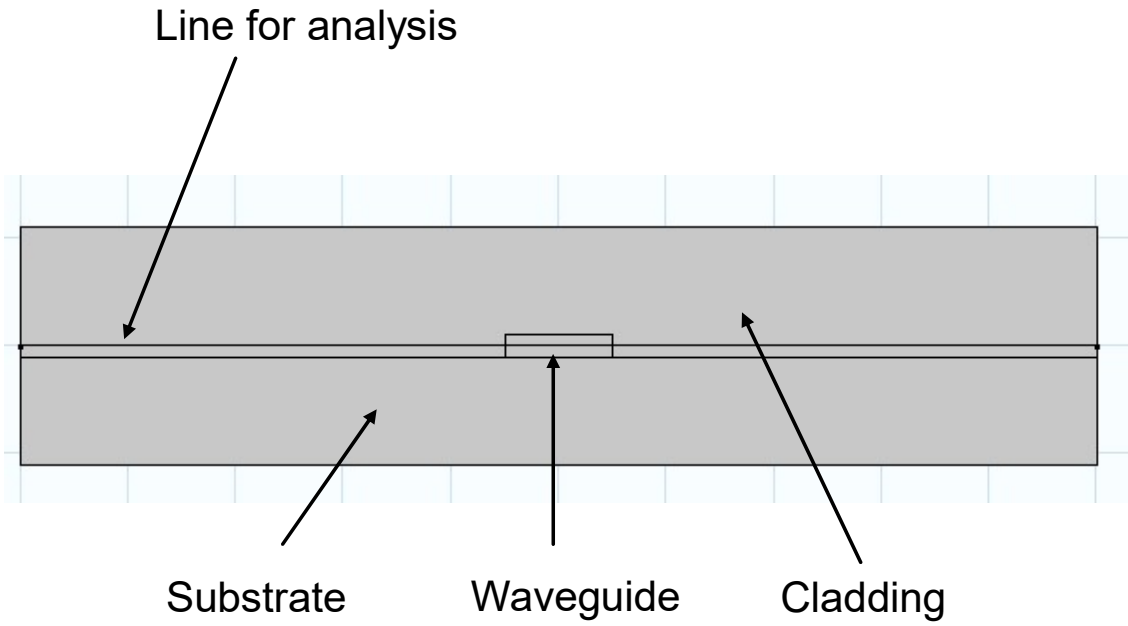
- Goal of todays tutorial
- Simulate modes in waveguide cross section
- Analyse geometric influence on modes
- Get an understanding of effective refractive index



Manuel Kohli – manuel.kohli@ief.ee.ethz.ch
Raphael Schwanninger– raphael.schwanninger@ief.ee.ethz.ch

Design Geometry

Parameter	Value
f0	c_cons/wl
n_clad	1
n_core	3.47
n_sub	1.45
sim_height	10*wg_height
sim_width	10*wg_width
wg_height	220[nm]
wg_width	750[nm]
wl	1550[nm]
mesh_size	??



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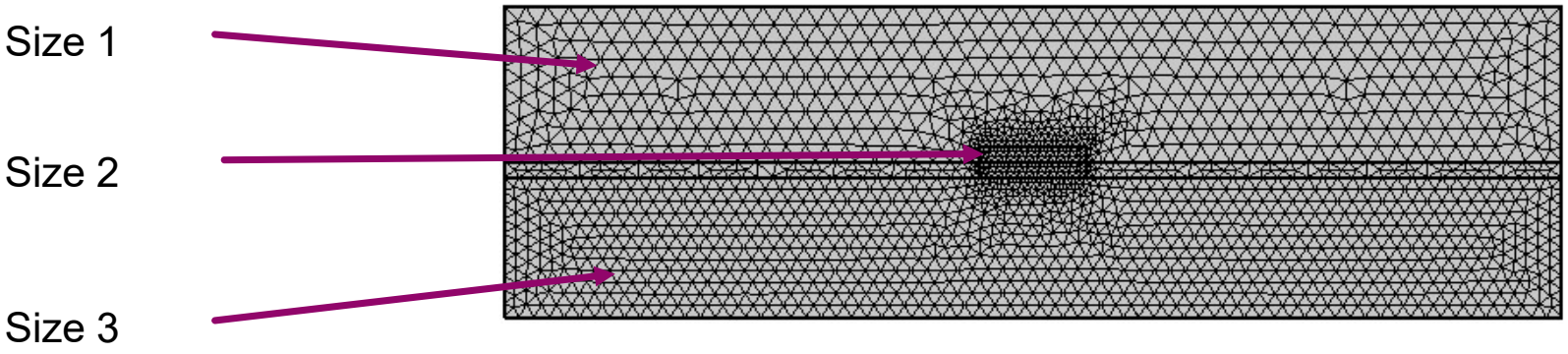
Define Materials &Mesh

- Materials
  - Define materials using the refractive index in the parameter definition
  - Hint: Change Wave Equation, electric Displacement Field to : Refractive Index

- Mesh
  - Define a mesh size for each material (3 sizes total)
  - Make the mesh size dependent on the wavelength and refractive index (λ/n core/10)



Study

- Study needed for this tutorial

  - Mode analysis
    - Define frequency
    - Desired number of modes: 4
    - Search for modes around shift : ??? (Hint: For which effective refractive index is the mode confined)

- Parameter Sweep for geometrical analysis

What should be Analysed ?

1) Get a feeling for structure:
   - Vary waveguide geometry and analyse modes
     - Analyse E & H Fields (2 D plots)
   - Understand correlation confinement of wave and effective mode index

2) Plot Fields along line through waveguide
   - 1D plot → Line Graph
   - Select line along which should be plotted

- 3) Analyse effective mode index dependency of wg_width

  - Derive values from Simulation
    - Derived Values → Global Evaluation 1 → Select correct Dataset
      Table columns: Inner solutions
      Expression: slect the effective mode index
  - Evaluate will create a table with the solutions

  - Create plot wg_width vs effective mode index
    - 1D plot→ Table Graph → Select correct table

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