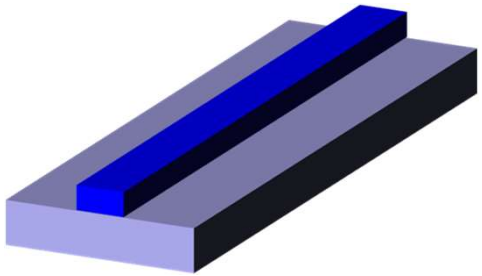
ETH zürich

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

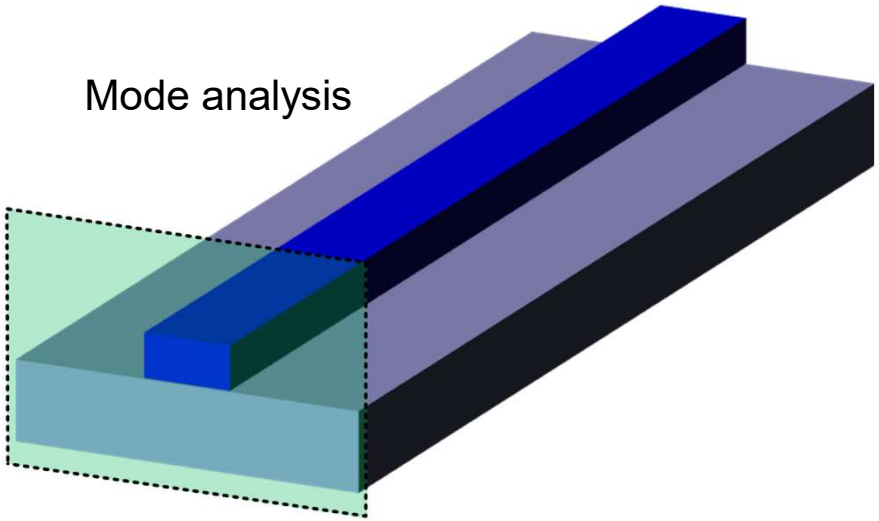
Manuel Kohli & Raphael Schwanninger

Waveguiding in COMSOL



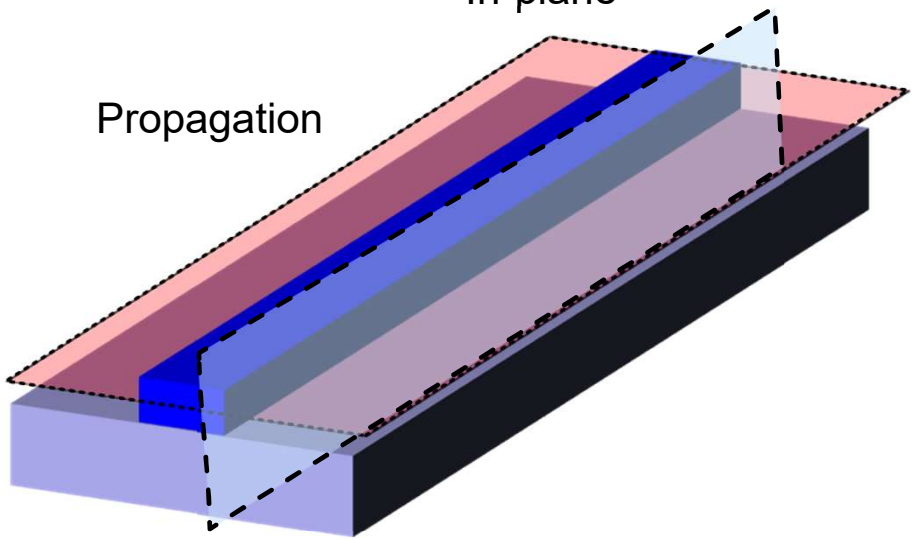
Out-of-plane

Mode analysis



In-plane

Propagation



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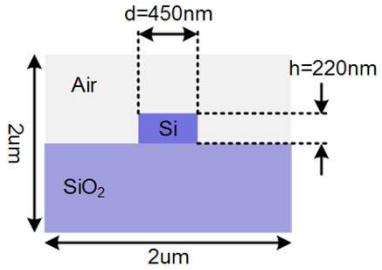
Waveguiding in COMSOL

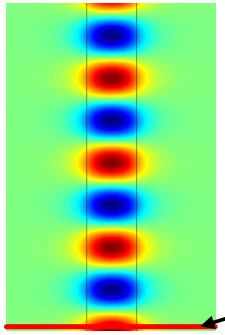
- Propagation
  - *Out-of-plane*: *Ports are not* defined (eigenvalue solution to the whole geometry)
  - *In-plane*: *Ports* need to be defined (eigenvalue solution to the defined port)

Next week



Out-of-plane ← *Excitation from surface plane* ← *Electromagnetics node: NO PORT*

TODAY



In-plane ← *Excitation from boundary* ← *Electromagnetics node: TE or TM*

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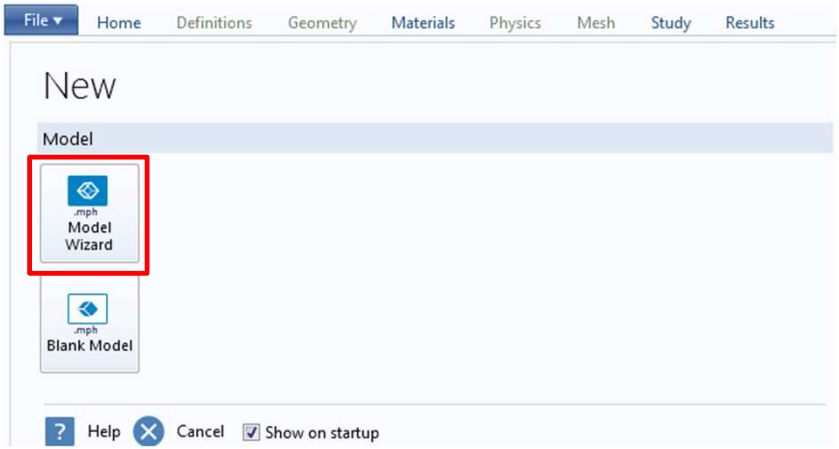
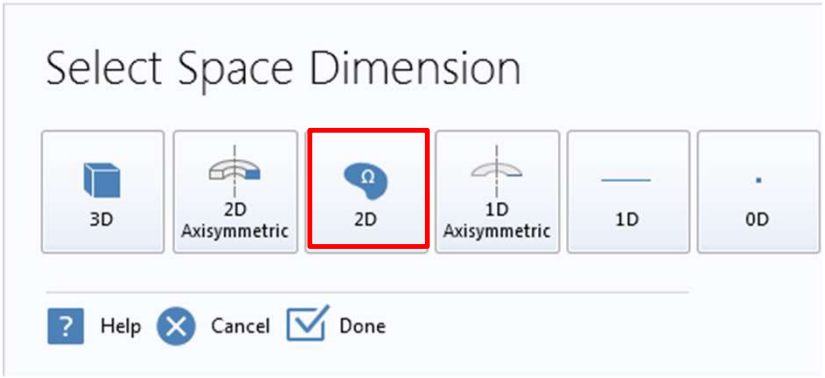
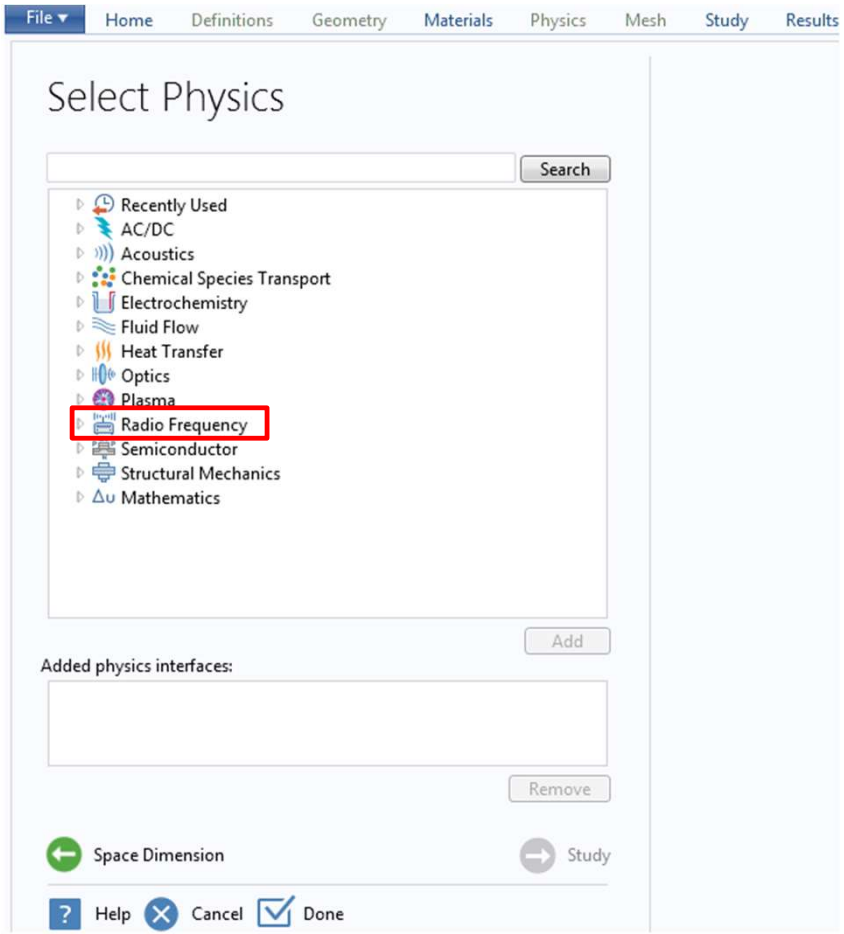
Set up Environment







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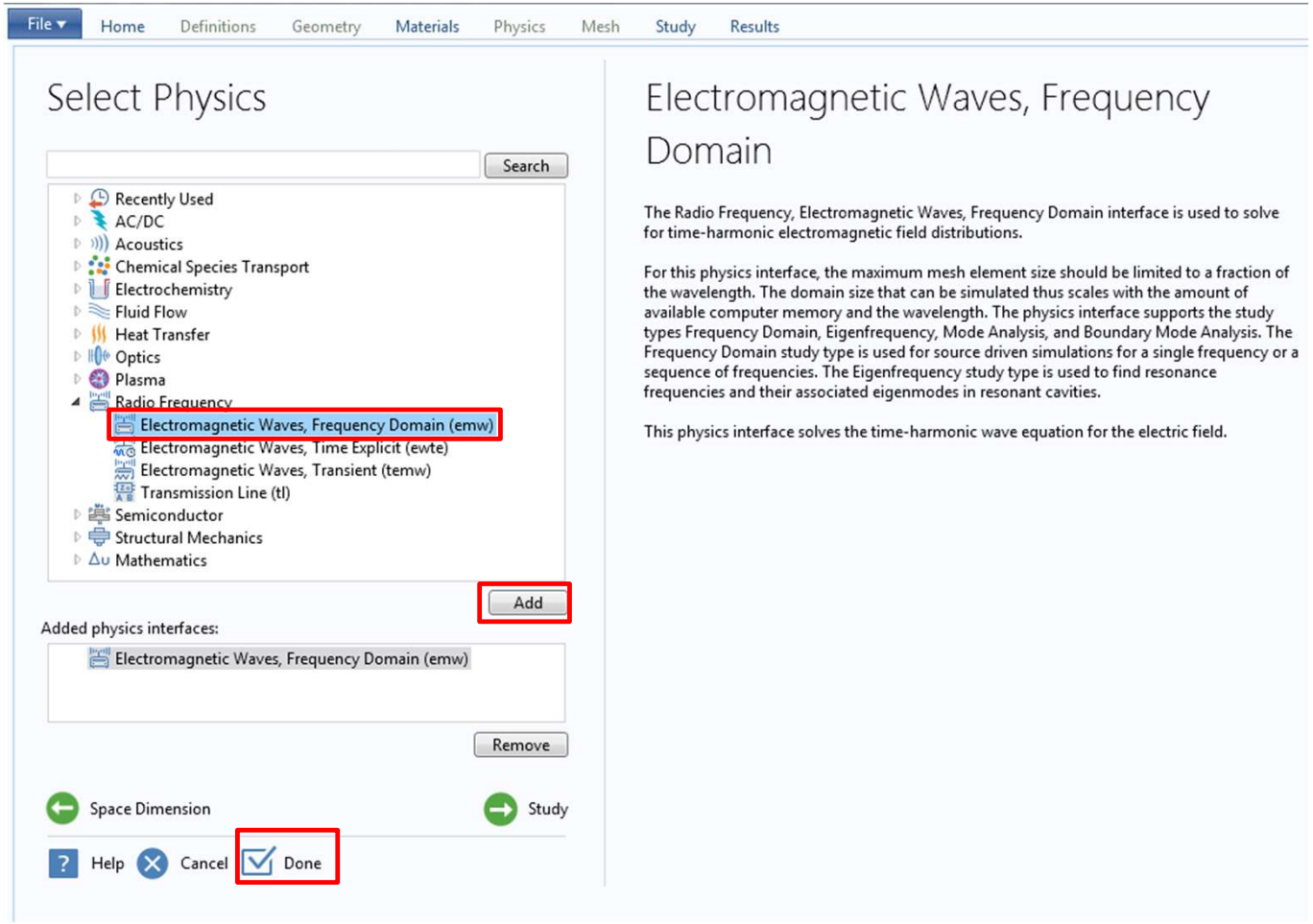
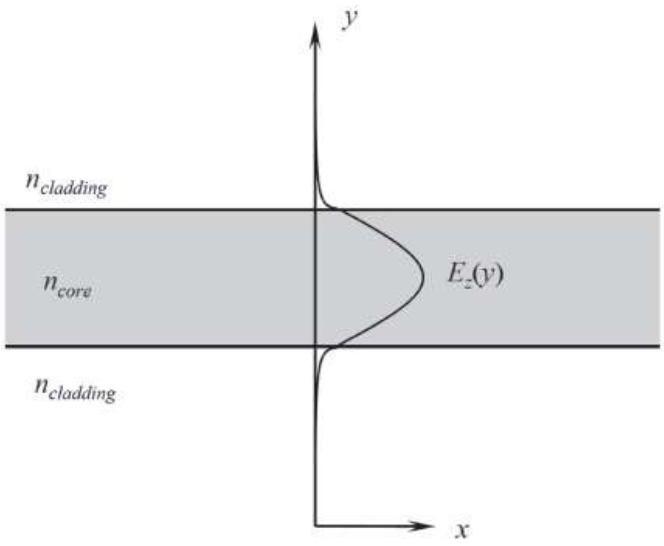
Set up Environment



Set up Environment

Parameters

Name	Expression	Value
lambda0	1550[nm]	1.55E-6 m
n_core	1.5	1.5
n_cladding	1	1
h_core	2.5[um]	2.5E-6 m
h_cladding	7[um]	7E-6 m
w_slab	50[um]	5E-5 m
f0	c_const/lambda0	1.9341449E14...

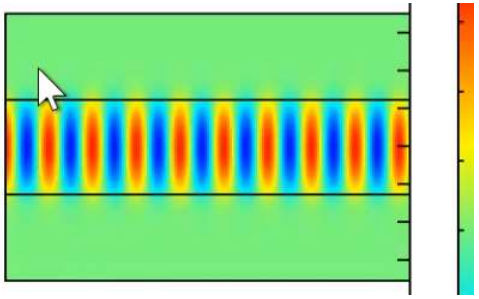


Define: Mesh & Port Definition & Study

- Port Definition
  - Left «excitation» port
  - Right «collection» port
  - Type off port: Numeric
- Mesh
  - Cladding: finer
  - Core: lamda0/n_core/4

- Study
  - Right click → Study Steps → Boundary Mode analysis (Has to be Step 1)
    - Set frequency
    - Desired number of modes : 1
    - Search for modes around: n_core
  - Same for Port 2

Study



- Show E-field in waveguide
  - Which field component has to be plotted?
- 1D- Plots
  - Show Field at Port 1
- Replace Port 2 with Perfect Electric Conductor
  - What changes?
- Investigate the confinement of the wave to waveguide using a parameter sweep and no changing of the geometry
  - Port 2 active
  - Which parameter needs to be swept (talk to lecturers)?
  - What can you see?
- Disable Parametric sweep, Change the number of allowed modes and study the E-fields