



OPENCADD
MODEL - BASED DESIGN DRIVEN COMPANY

*Modeling
for life!*

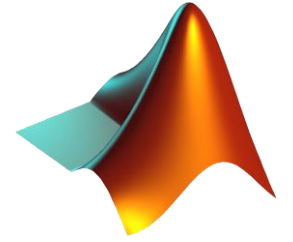
MATLAB & Simulink



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Application Engineer
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MATLAB Product Family



Parallel Computing

Parallel Computing Toolbox
MATLAB Parallel Server

AI, Data Science, and Statistics

Deep Learning Toolbox
Statistics and Machine Learning Toolbox
Curve Fitting Toolbox
Text Analytics Toolbox

Math and Optimization

Optimization Toolbox
Global Optimization Toolbox
Symbolic Math Toolbox
Mapping Toolbox
Partial Differential Equation Toolbox

Reporting and Database Access

Database Toolbox
MATLAB Report Generator

Code Generation

MATLAB Coder
Embedded Coder
HDL Coder
HDL Verifier
Filter Design HDL Coder
Fixed-Point Designer
GPU Coder

Application Deployment

MATLAB Compiler
MATLAB Compiler SDK
MATLAB Production Server
MATLAB Web App Server

Verification, Validation, and Test

Requirements Toolbox
MATLAB Test

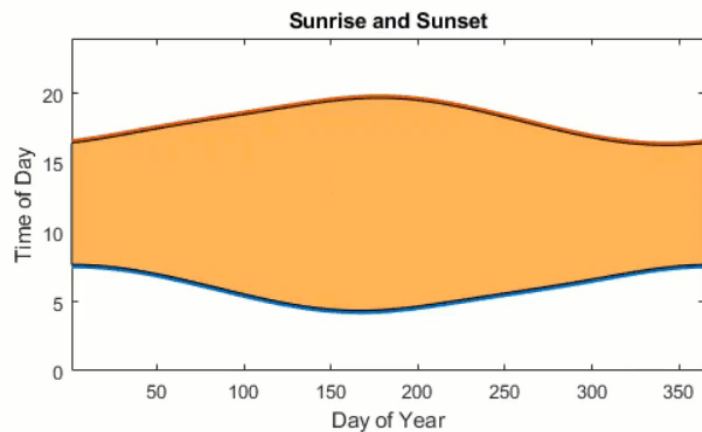
MATLAB Live Editor

Estimating Sunrise and Sunset

Estimate sunrise and sunset times for a given longitude and latitude. Using the latitude (ϕ), the sun's declination (δ) and the solar time correction (SC) we can calculate sunrise and sunset times.

$$\text{sunrise} = 12 - \frac{\cos^{-1}(-\tan \phi \tan \delta)}{15^\circ} - \frac{SC}{60} \quad \text{sunset} = 12 + \frac{\cos^{-1}(-\tan \phi \tan \delta)}{15^\circ} - \frac{SC}{60}$$

longitude
 latitude



Definite Integrals in Maxima and Minima

To maximize $F(a) = \int_{-a}^a \sin(ax) \sin(x/a) dx$ for $a \geq 0$, first, define the symbolic variables and assume that $a \geq 0$:

```
syms a x  
assume(a >= 0);
```

Then, define the function to maximize:

```
F = int(sin(a*x)*sin(x/a), x, -a, a)
```

Note the special case here for $a = 1$. To make computations easier, use `assumeAlso` to ignore this possibility.

```
assumeAlso(a ~= 1);  
F = int(sin(a*x)*sin(x/a), x, -a, a)
```

Create a plot of F to check its shape:

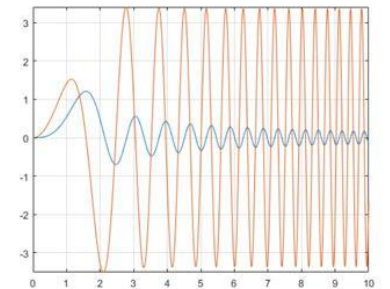
```
fplot(F, [0 10])
```

Use `diff` to find the derivative of F with respect to a . The zeros of F_a are the local extrema of F .

```
Fa = diff(F, a);  
hold on
```

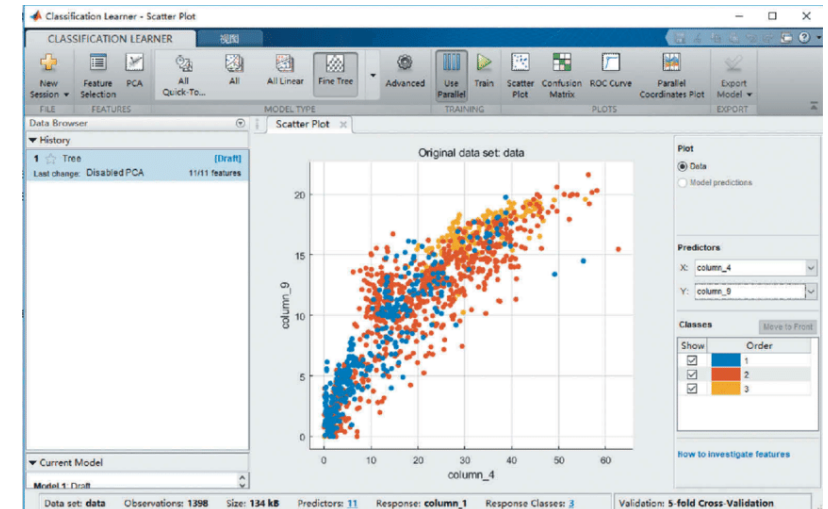
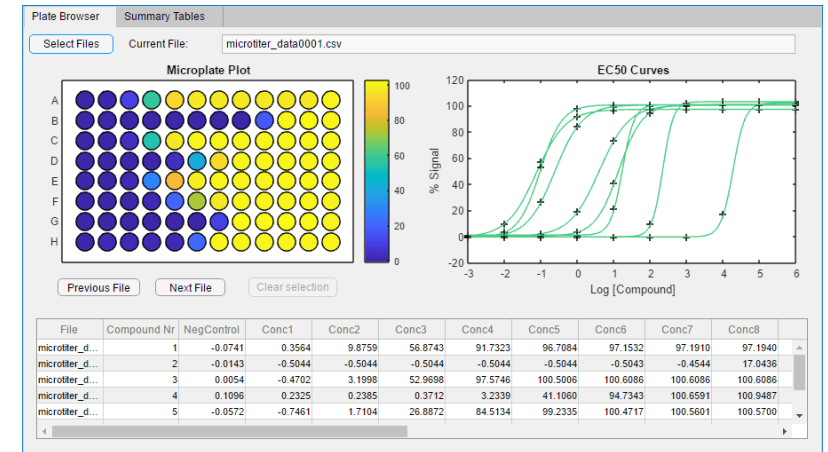
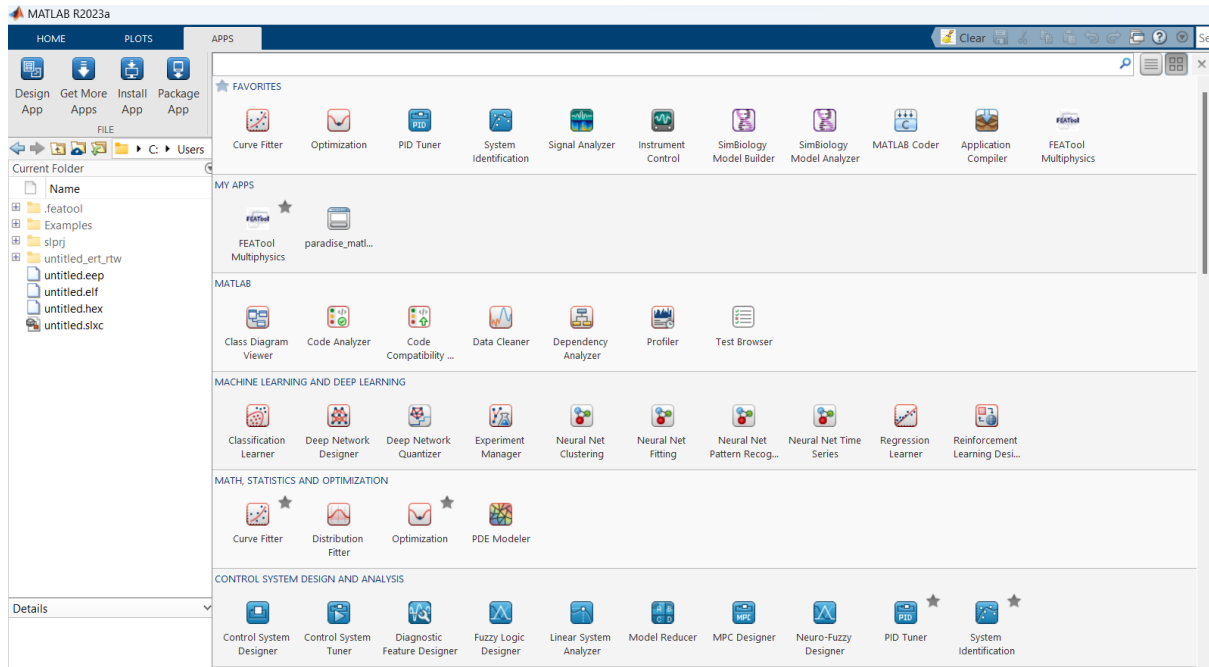
$$F = \begin{cases} 1 - \frac{\sin(2)}{2} & \text{if } a = 1 \\ \frac{2a(\sin(a^2)\cos(1) - a^2\cos(a^2)\sin(1))}{a^4 - 1} & \text{if } a \neq 1 \end{cases}$$

$$F = \frac{2a(\sin(a^2)\cos(1) - a^2\cos(a^2)\sin(1))}{a^4 - 1}$$

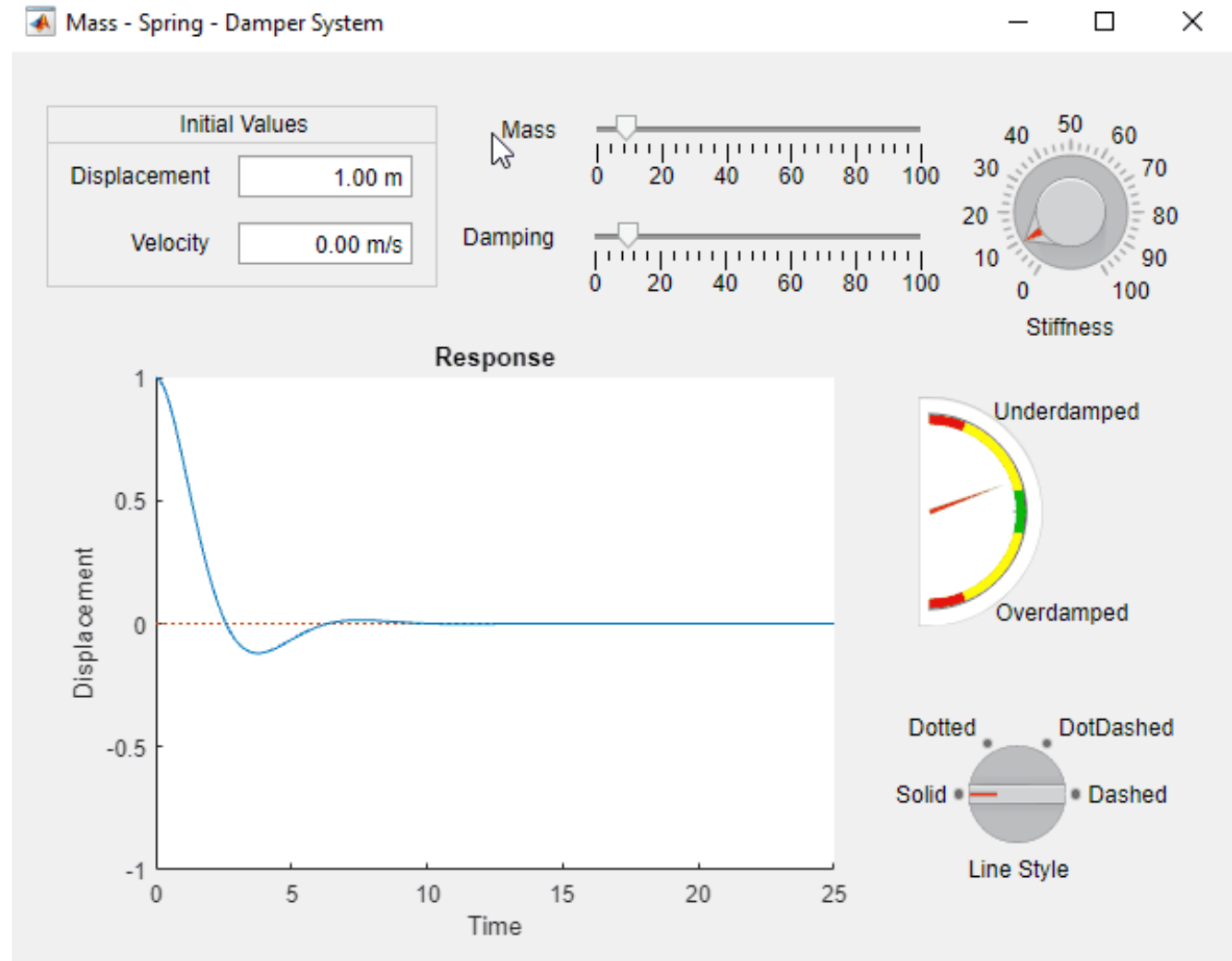
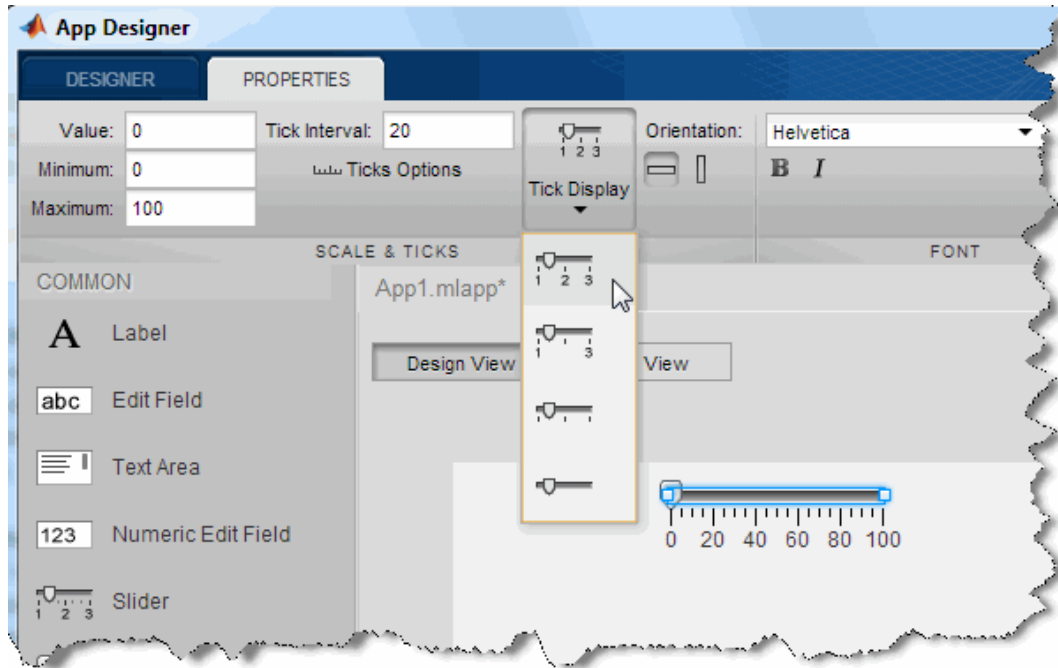


MATLAB Apps

MATLAB[®] apps are interactive applications written to perform technical computing tasks.



MATLAB App Designer

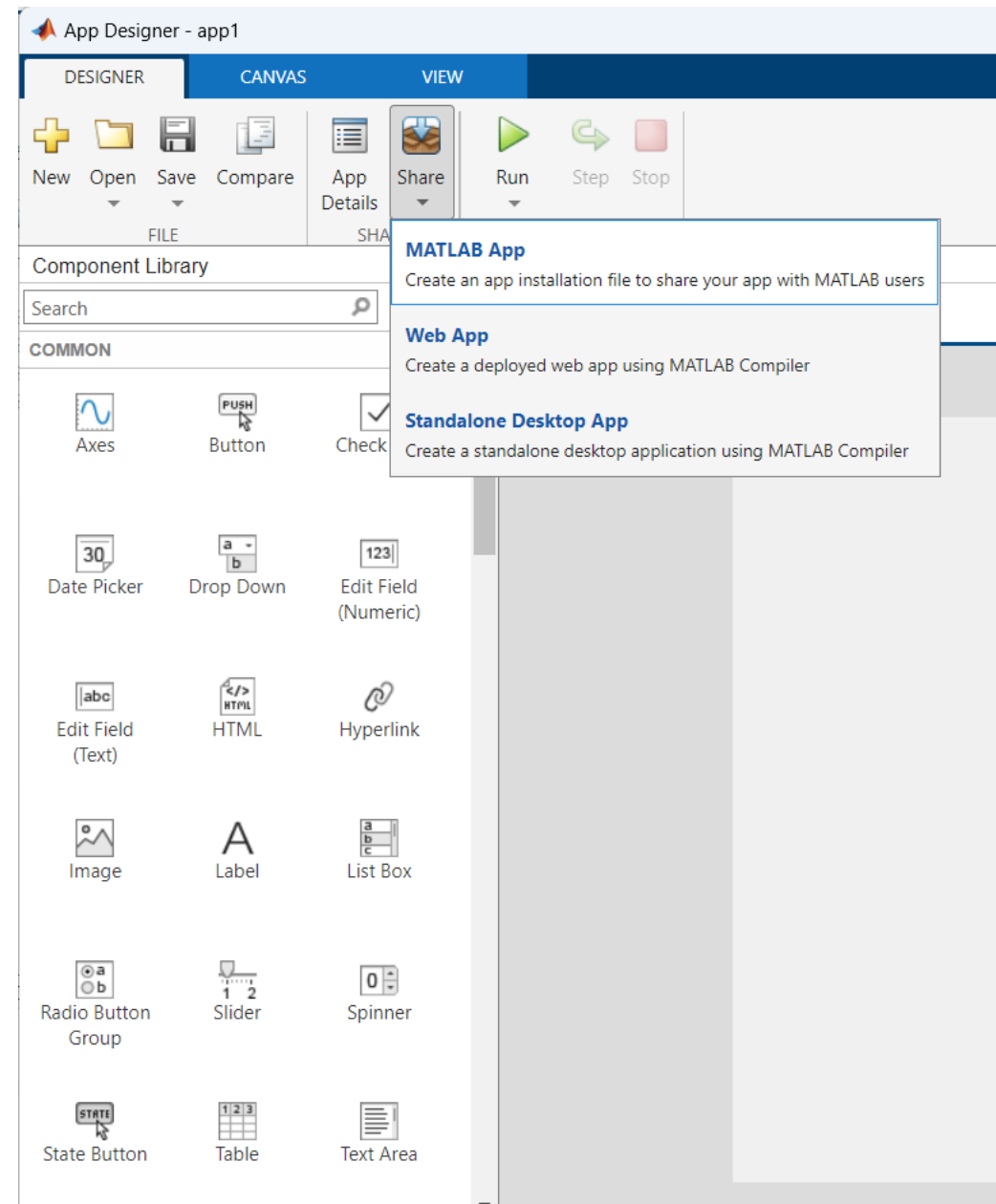


Share App with others

1) MATLAB App

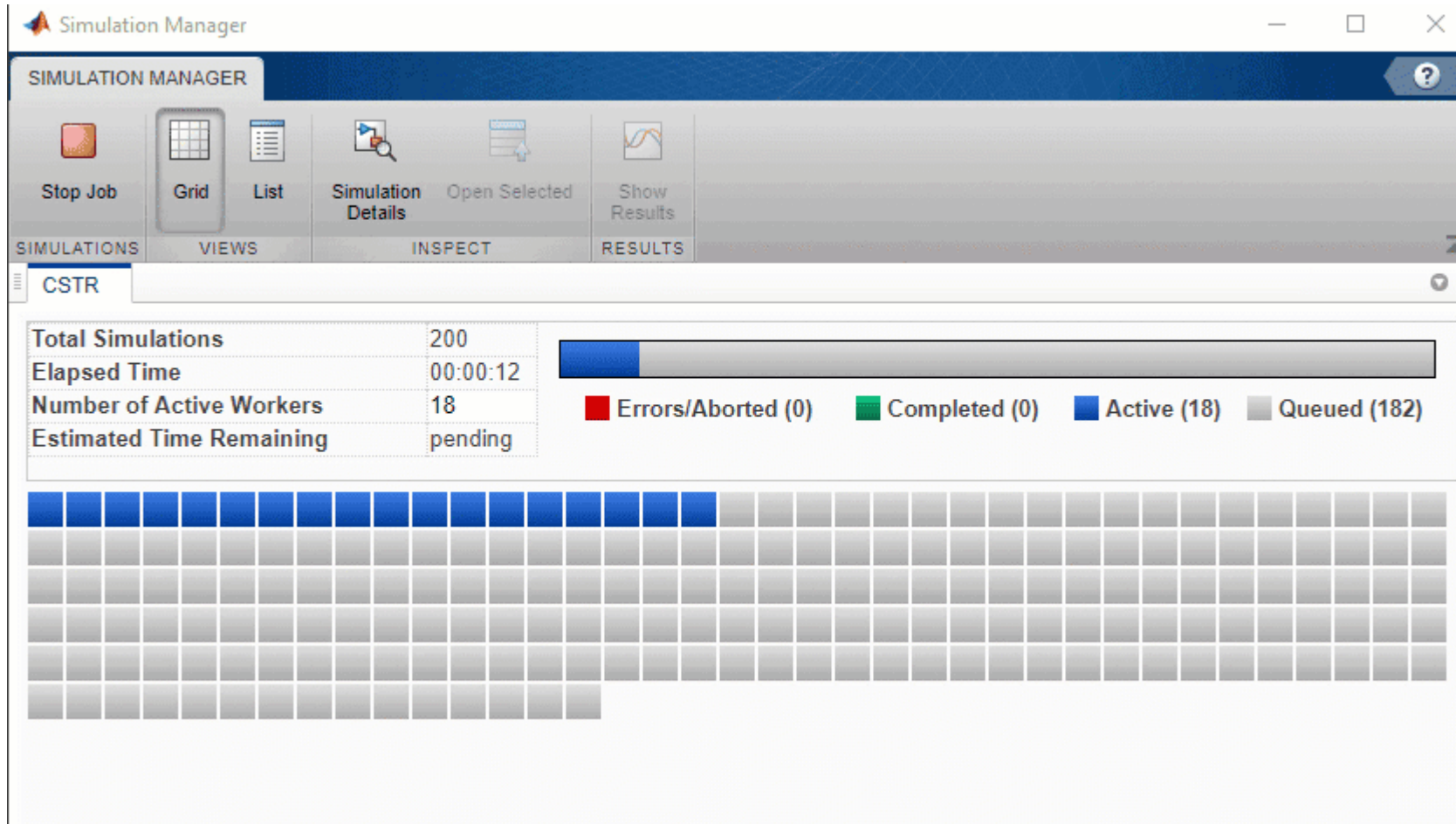
2) Web App

3) Standalone Desktop App

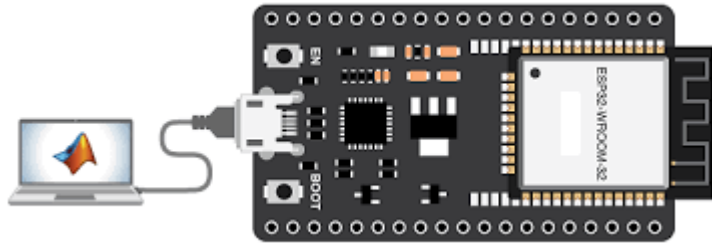


Parallel Computing Toolbox

Parallel Computing Toolbox lets you solve computationally and data-intensive problems using multicore processors, GPUs, and computer clusters.



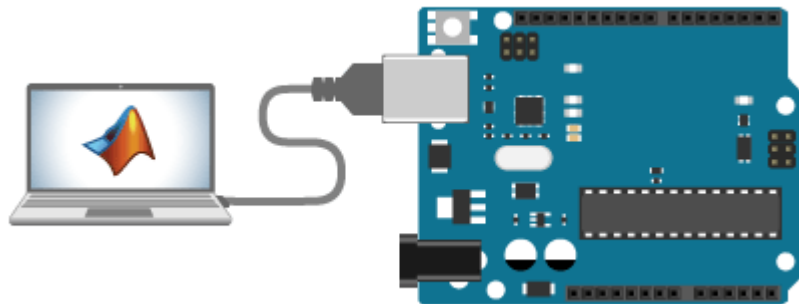
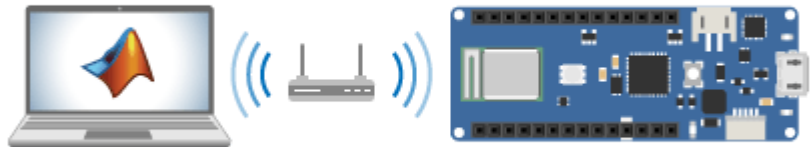
Connect MATLAB to Hardware



Speedgoat



Raspberry PI



National Instrument

Simulink Product Family

Event-Based Modeling

Stateflow
SimEvents

Physical Modeling

Simscape
Simscape Battery
Simscape Driveline
Simscape Electrical
Simscape Fluids
Simscape Multibody

Real-Time Simulation and Testing

Simulink Real-Time
Simulink Desktop Real-Time

Reporting

Simulink Report Generator
Simulink 3D Animation

Systems Engineering

System Composer
Requirements Toolbox

Code Generation

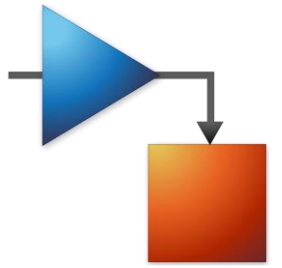
Simulink Coder
Embedded Coder
DDS Blockset
AUTOSAR Blockset
C2000 Microcontroller Blockset
Fixed-Point Designer
Simulink PLC Coder
Simulink Code Inspector
DO Qualification Kit (for DO-178)
IEC Certification Kit (for ISO 26262 and IEC 61508)
HDL Coder
HDL Verifier

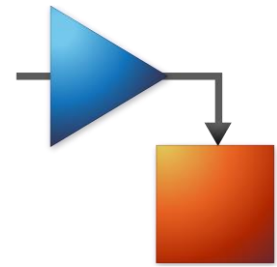
Application Deployment

Simulink Compiler

Verification, Validation, and Test

Requirements Toolbox
Simulink Check
Simulink Coverage
Simulink Design Verifier
Simulink Test
Polyspace Access
Polyspace Bug Finder
Polyspace Bug Finder Server
Polyspace Code Prover
Polyspace Code Prover Server
Polyspace Client for Ada
Polyspace Server for Ada





Simulink Library Browser

chart

Simscape/Electrical/Semiconductors & Converters

- Instrument Control Toolbox
- Lidar Toolbox
- Mixed-Signal Blockset
- Model Predictive Control Toolbox
- Motor Control Blockset
- Motor Control Blockset HDL Support
- Navigation Toolbox
- Phased Array System Toolbox
- Powertrain Blockset
- Radar Toolbox
- Reinforcement Learning
- Report Generator
- Requirements Toolbox
- RF Blockset
- Robotics System Toolbox
- Robot Control Toolbox
- ROS Toolbox
- Sensor Fusion and Tracking Toolbox
- SerDes Toolbox
- SimEvents
- SimScape
 - Foundation Library
 - Utilities
 - Battery
 - Driveline
 - Electrical
 - Connectors & References
 - Control
 - Electromechanical
 - Integrated Circuits
 - Passive
 - Semiconductors & Converters
 - Converters
 - Sensors & Transducers
 - Sources
 - Switches & Breakers
 - Utilities

Converters

Current Limiter

Diode

Gate Driver

GTO

Half-Bridge (Ideal, Switching)

Half-Bridge Driver

Ideal Semiconductor Switch

IGBT (Ideal, Switching)

MOSFET (Ideal, Switching)

N-Channel IGBT

N-Channel JFET

N-Channel LDMOS FET

N-Channel MOSFET

NPN Bipolar Transistor

Optocoupler

P-Channel JFET

P-Channel LDMOS FET

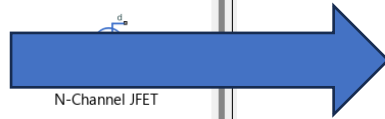
P-Channel MOSFET

PNP Bipolar Transistor

SPICE-Imported MOSFET

Thyristor

Thyristor (Piecewise Linear)



Block Parameters: N-Channel IGBT

N-Channel IGBT Auto Apply

Settings Description

NAME	VALUE
Modeling option	Full I-V and capacitance characteristics No thermal port
Main	
I-V characteristics defined by	Fundamental nonlinear equations
Zero gate voltage collector current, Ices	2 mA
Voltage at which Ices is defined	600 V
Gate-emitter threshold voltage, Vge(th)	6 V
Collector-emitter saturation voltage, Vce(sat)	2.6 V
Collector current at which Vce(sat) is defined	400 A
Gate-emitter voltage at which Vce(sat) is defined	10 V
Measurement temperature	25 degC
Junction Capacitance	
Parameterization	Specify fixed input, reverse transfer, and output capacitance
Input capacitance, Cies	26.4 nF
Reverse transfer capacitance, Cres	2.7 nF
Output capacitance, Coes	0 nF
Charge-voltage linearity	Gate-collector capacitance is constant
Total forward transit time	0 us
Advanced	
Temperature Dependence	

N-Channel IGBT

Simulink

The image displays two software windows. The left window is Simulink, titled "Wind_Turbine - Simulink prerelease use". It shows a block diagram of a wind turbine control system. The diagram includes a "Main Controller Wind_Input" block with three sub-blocks labeled S1, S2, and S3. It also features a "Pitch Controller", a "Yaw Controller", a "Blade Load Lift_and Drag" block, and a "Nacelle" block. The nacelle block is connected to a "Grid" block. The right window is "Mechanics Explorers - Mechanics Explorer-Wind_Turbine", which provides a 3D visualization of the wind turbine model. The visualization shows the blades, nacelle, and tower. The time displayed in the bottom right corner of the Mechanics Explorers window is 34.025464.

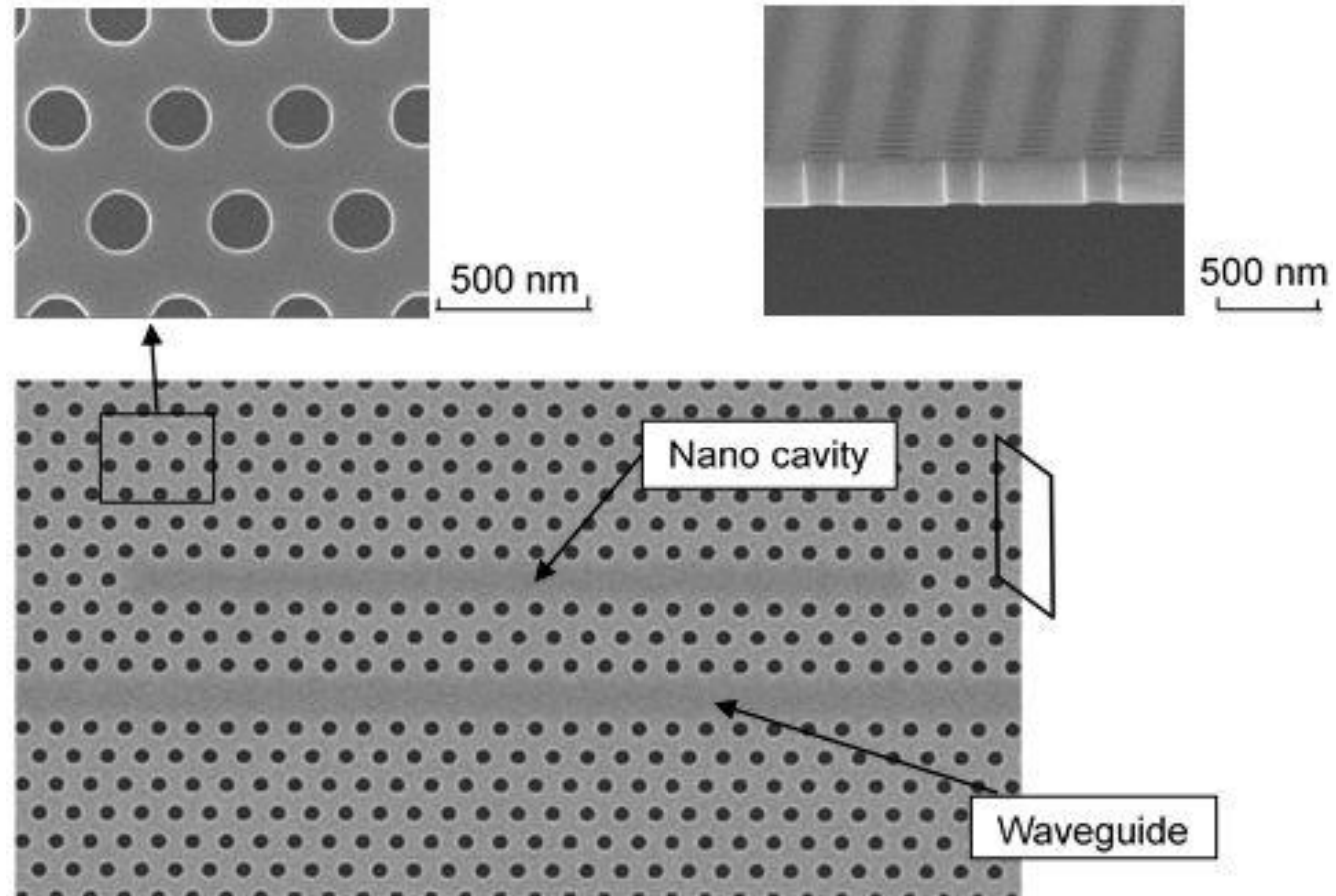
Wind Turbine

1. Open [Demo Script](#)
2. Solver Settings: [Desktop](#), [Real Time](#)
3. [Explore simulation results](#) using [sscexplore](#)

Configure Systems: [Default](#), [Settings](#)

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Light Propagation in a Photonic Crystal



Light Propagation in a Photonic Crystal

Simulation Parameters

maximum number of Gridpoints in one Dimension
500

ϵ - Background
1

μ - Background
1

Size x-Dimension [μm]
5

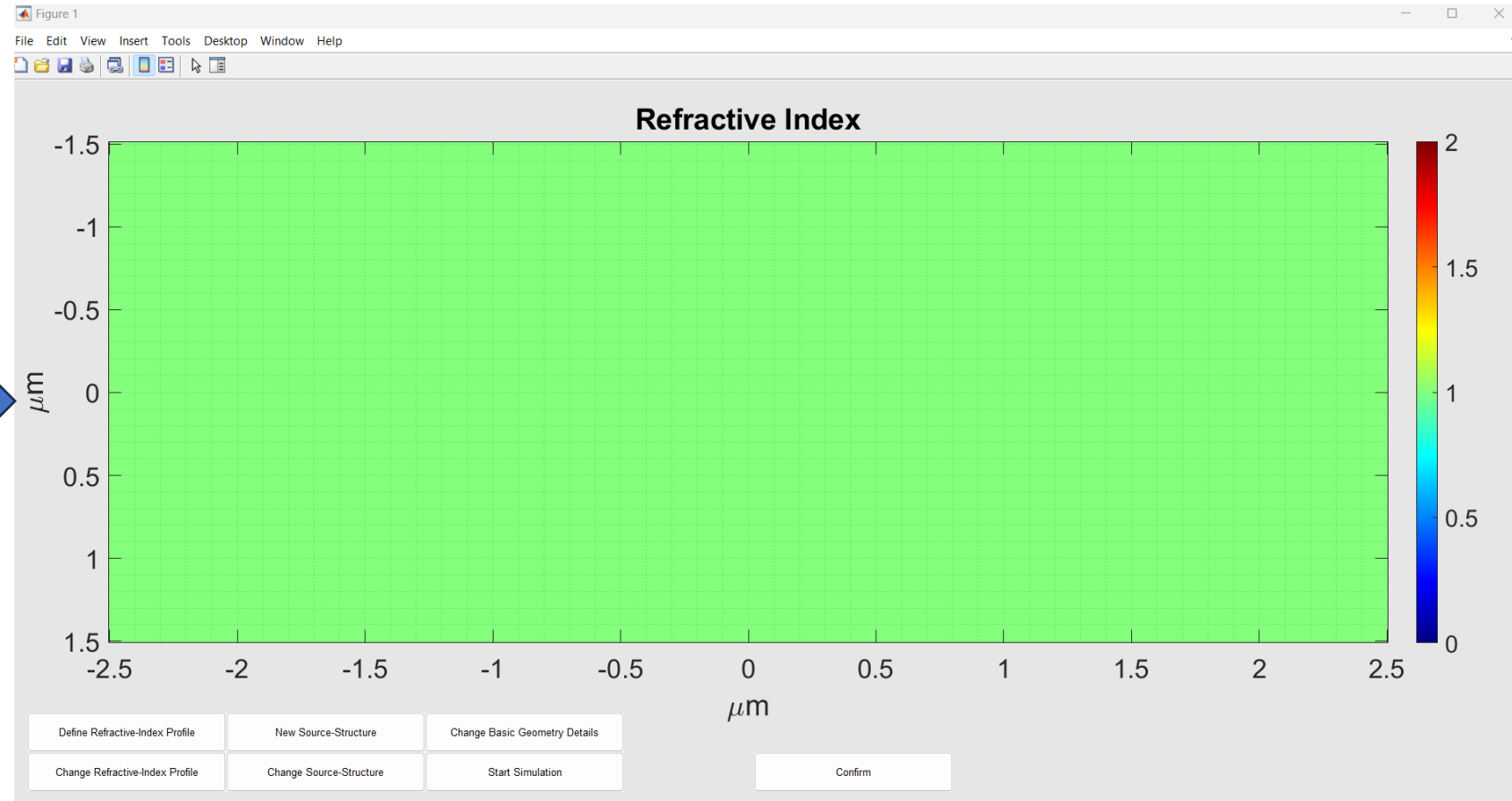
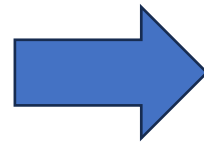
Size y-Dimension [μm]
3

Number of timesteps
300000

Number of Perfectly Matched Layers
10

axis equal
0

OK Cancel



Light Propagation in a Photonic Crystal

Structure

ϵ - Structure
9

μ - Structure
1

Softened Structures
0

Structure - 0 for Photonic Crystal - 1 for Square - 2 for Circular - 3 for Polygon
0

OK Cancel

periodic D...

Periodic Cell Size x-Dimension [μm]
0.25

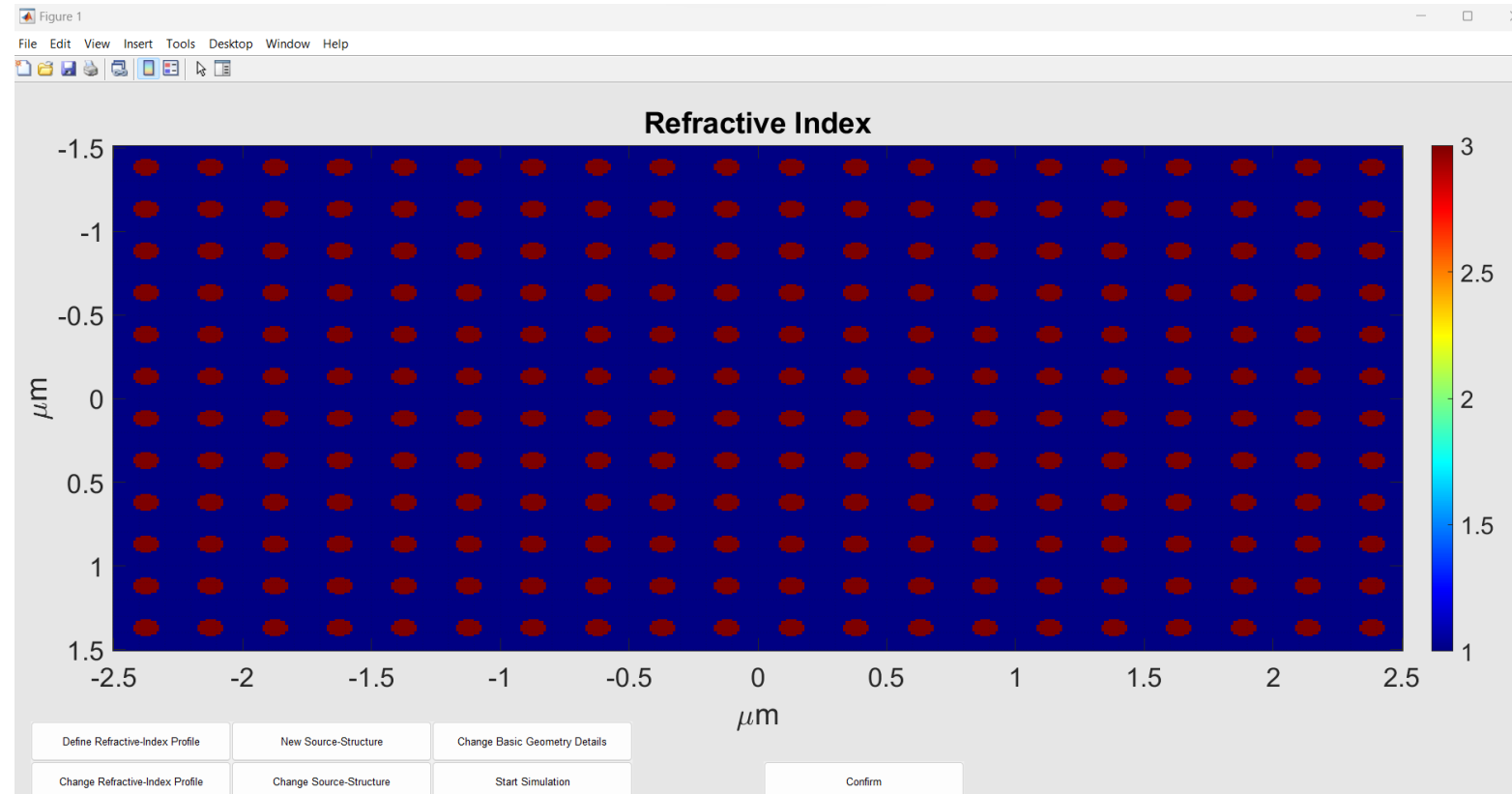
Periodic Cell Size y-Dimension [μm]
0.25

Structure Size x-Dimension [μm]
0.1

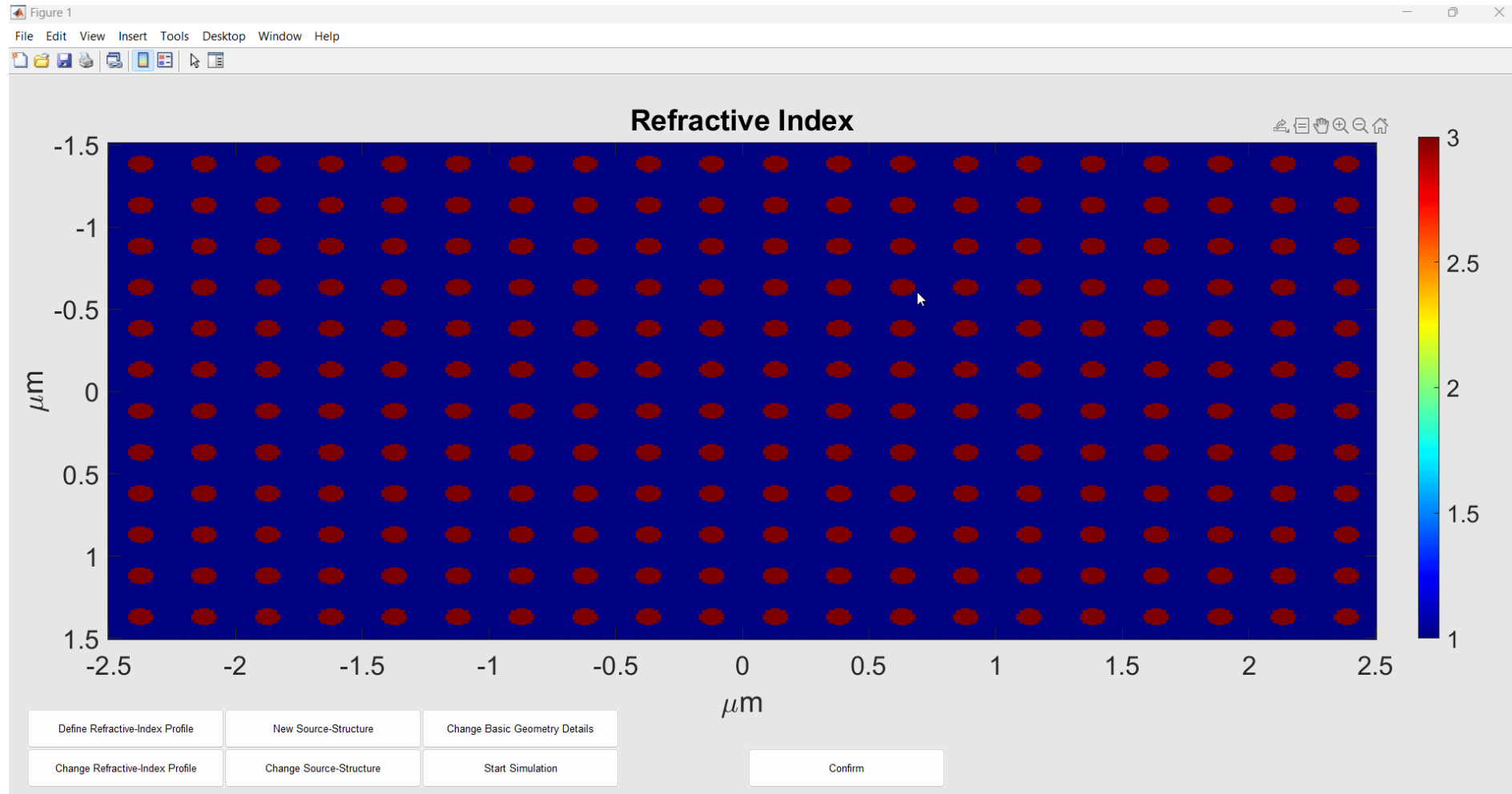
Structure Size y-Dimension [μm]
0.1

Structure -1 for Square - 2 for Circular
2

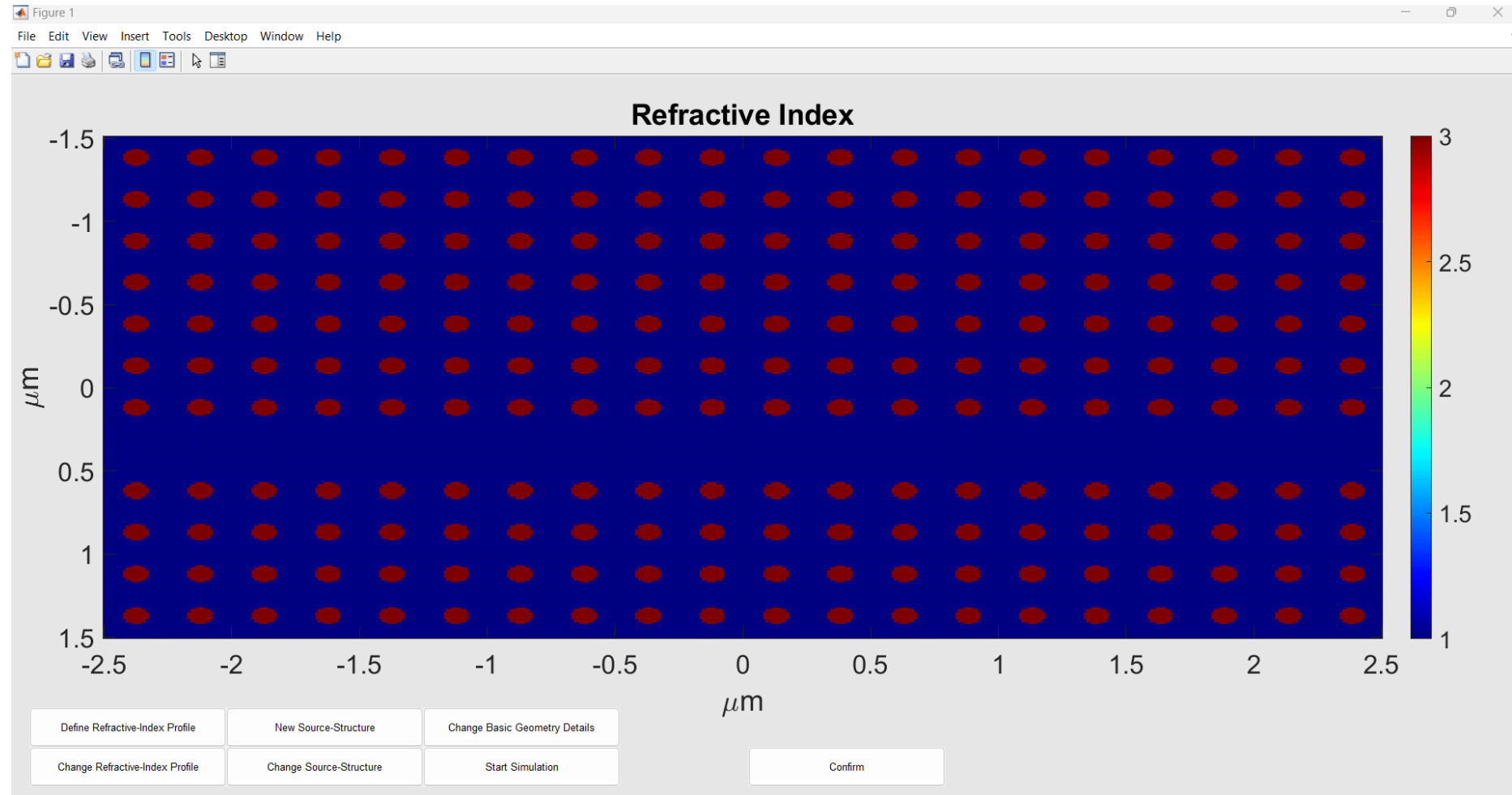
OK Cancel



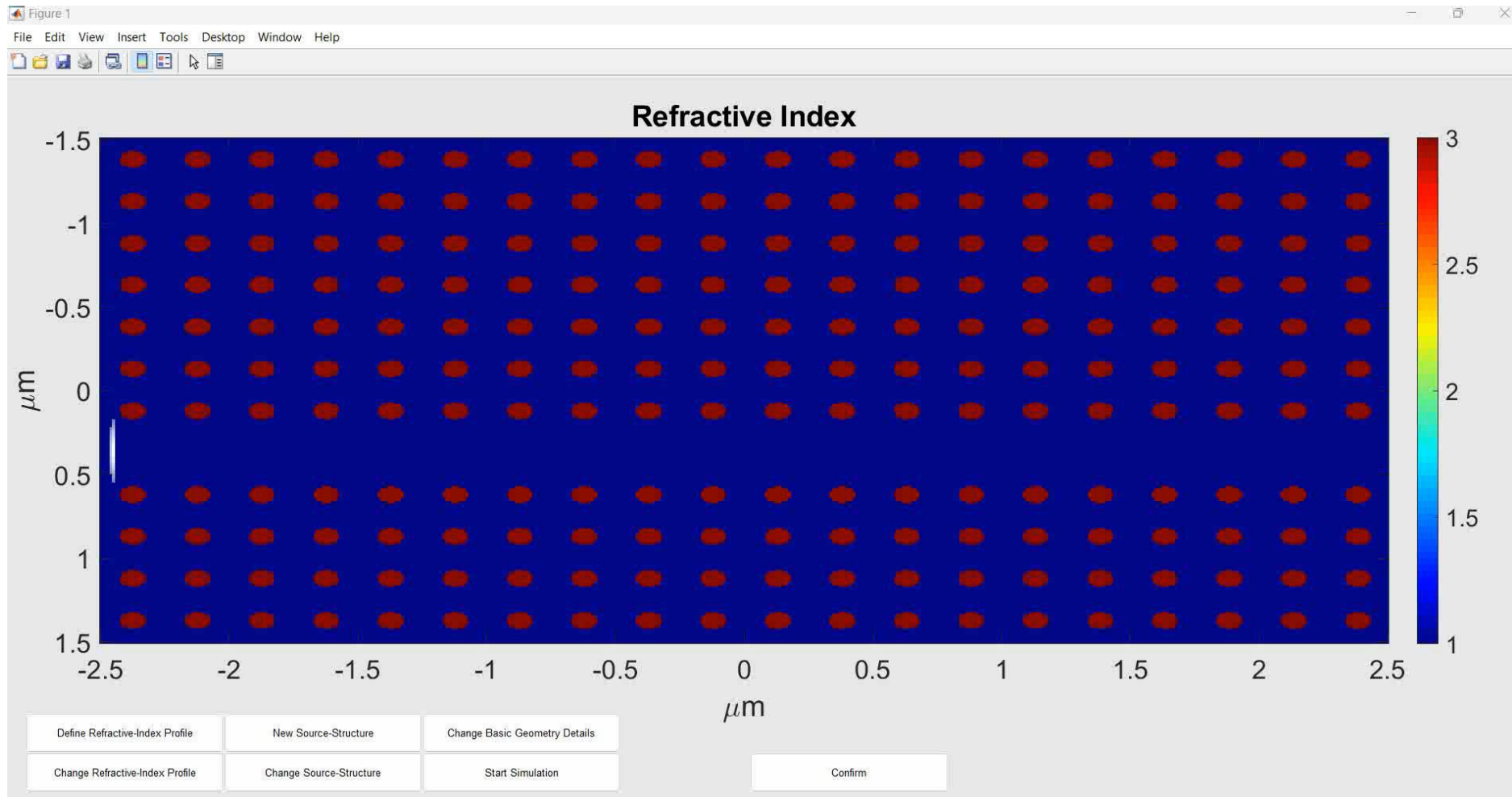
Light Propagation in a Photonic Crystal



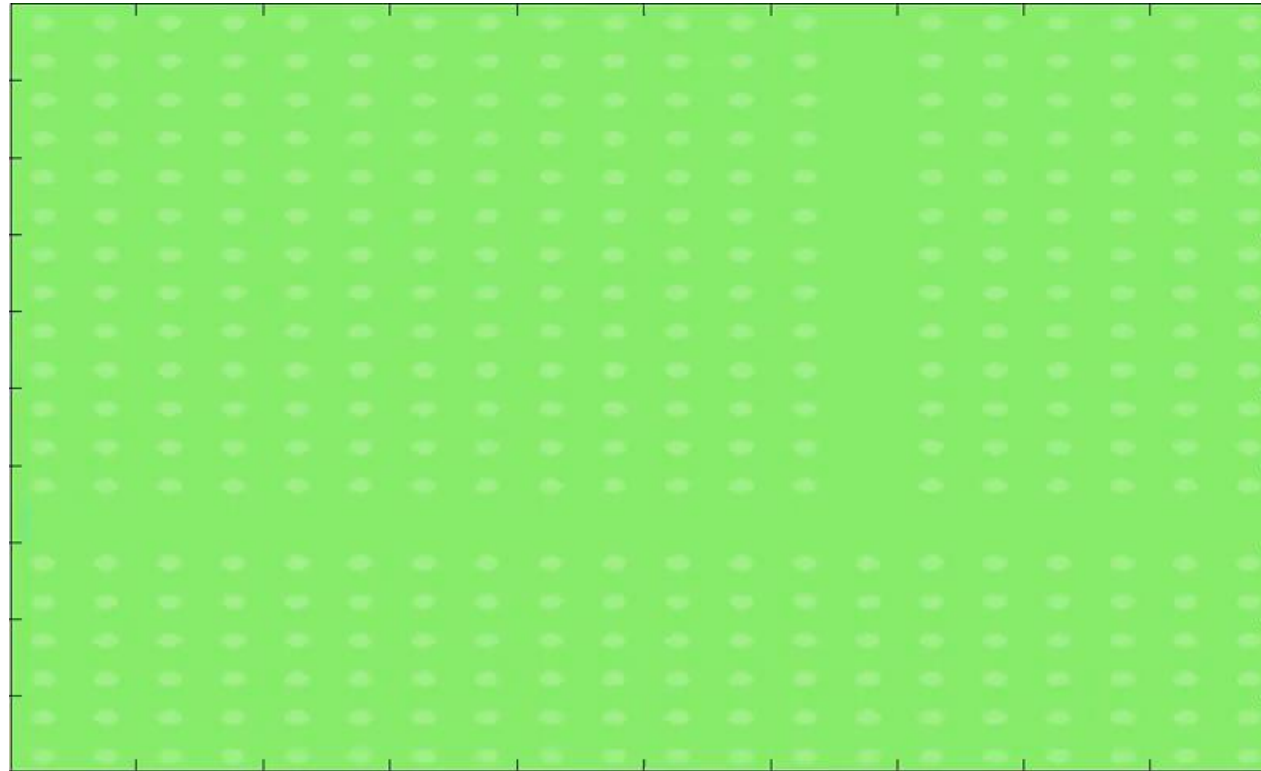
Light Propagation in a Photonic Crystal



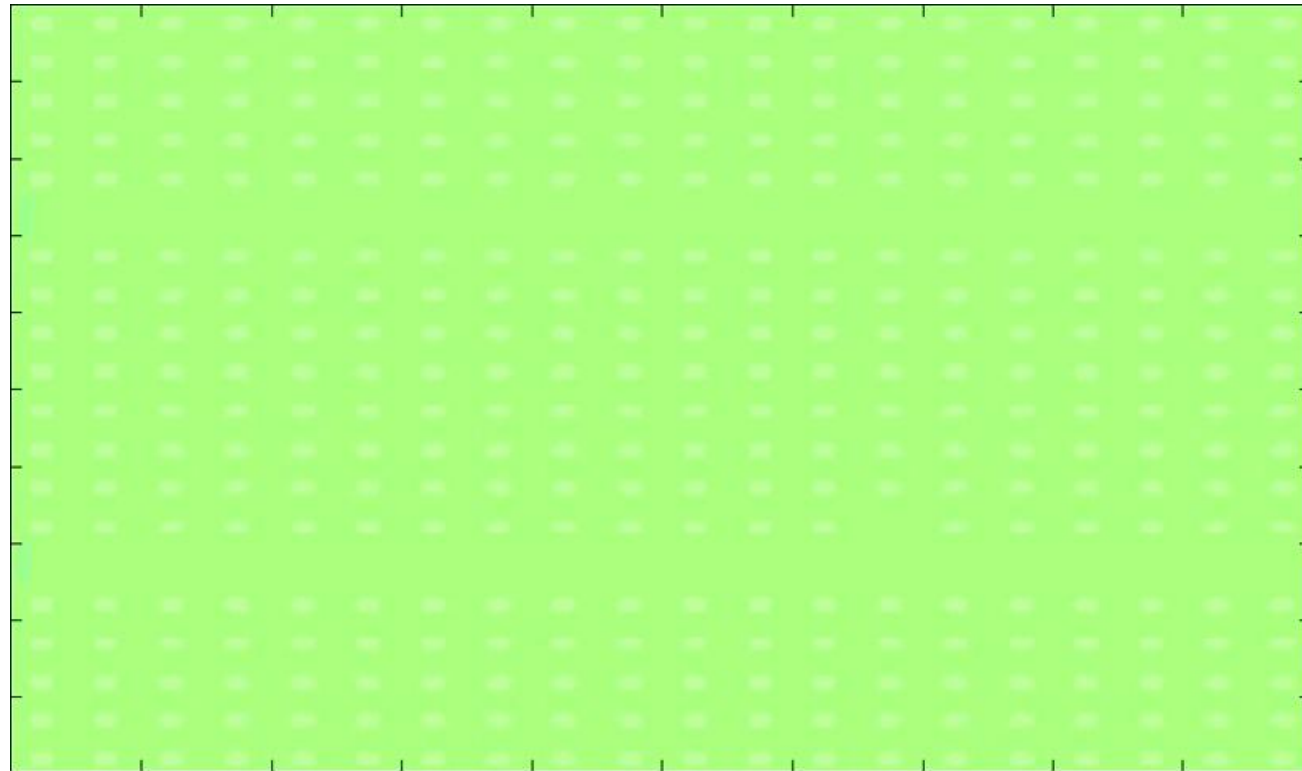
Light Propagation in a Photonic Crystal



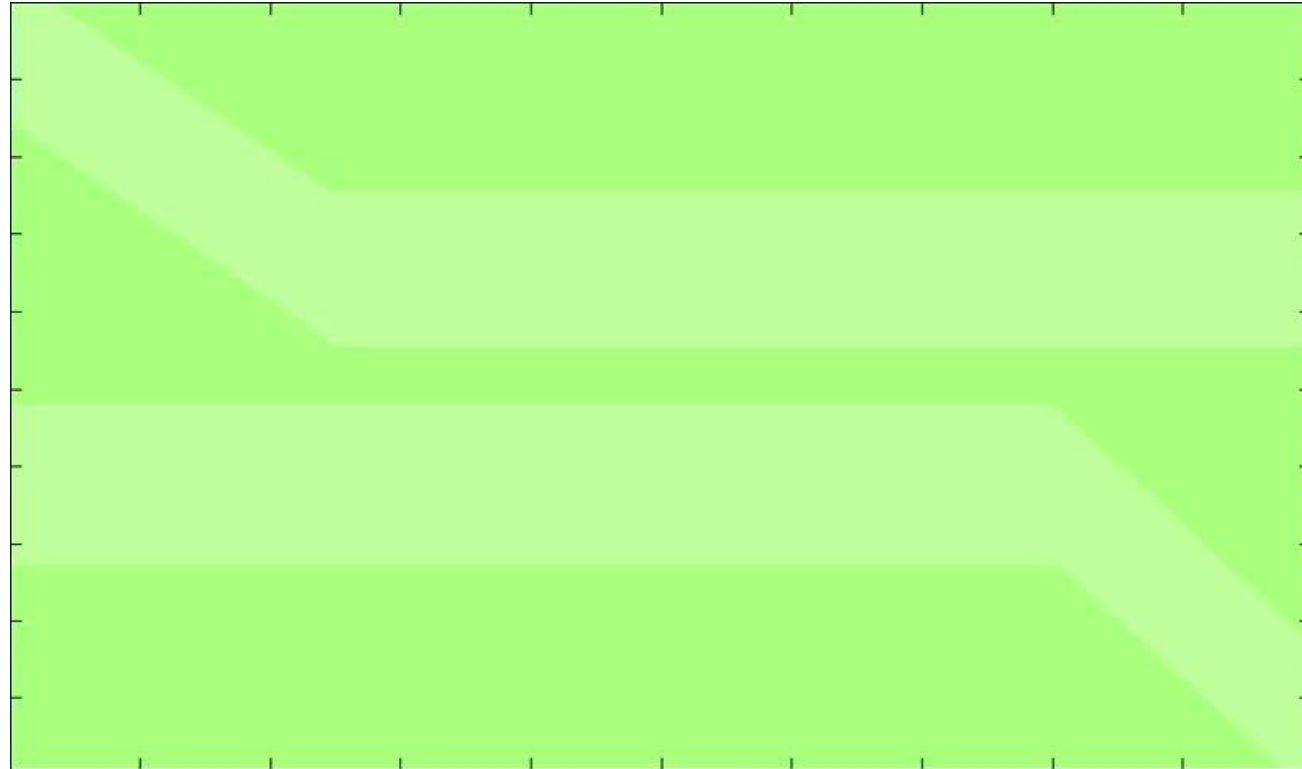
Photonic Crystal Waveguide Splitter



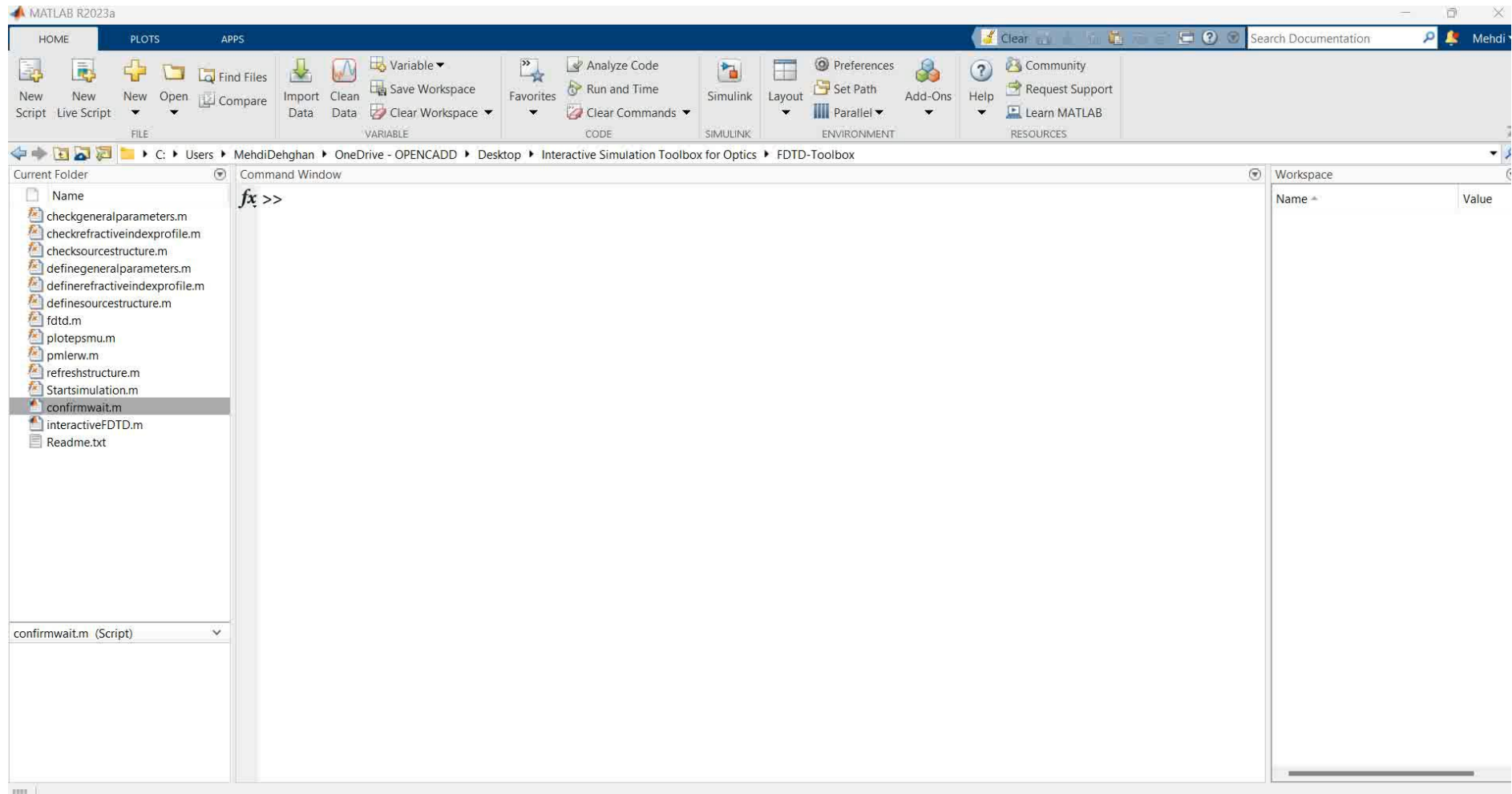
Photonic Crystal Waveguide - Defect Reflection



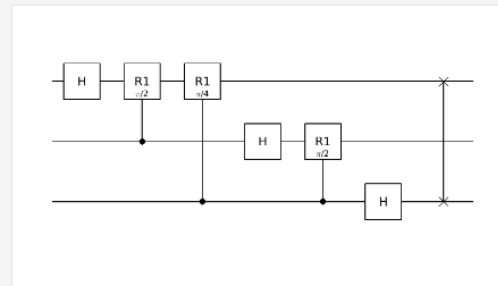
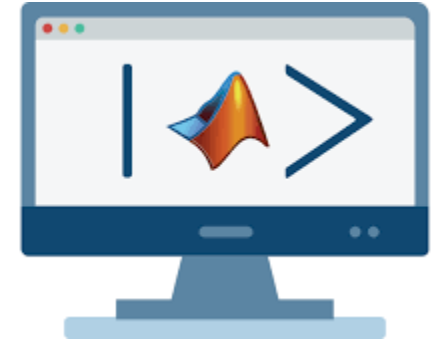
Photonic Crystal Waveguide Coupling



Finite Element with MATLAB



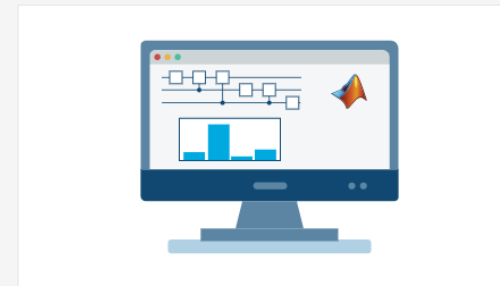
Quantum Computing with MATLAB



Build Quantum Circuits

Build quantum circuits using a sequence of quantum gates operating on one or more qubits. Use built-in, simple gates and create composite gates to capture complex operations and organize circuits.

- Quantum Computing Circuit
- Types of Quantum Gates



Simulate Quantum Algorithms Locally

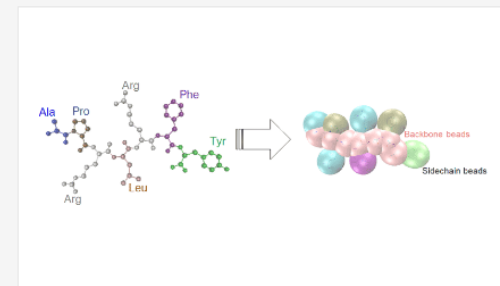
Verify quantum algorithms to confirm their behavior and expected outcomes by simulating the algorithms on your local computer. Inspect results by displaying the quantum state formula, plotting a histogram, or querying possible states.

- [Local Quantum State Simulation](#)



Execute Algorithms on Quantum Computers

Connect to quantum computers through cloud services and run the quantum algorithms. Use quantum simulators supplied by quantum hardware providers to validate complex quantum circuits before running them on QPU devices.



Discover Quantum Computing Applications

Leverage quantum computers to solve problems in optimization, machine learning, and chemistry.

- Grover's Algorithm
- Ground-State Protein Folding Using Variational Quantum Eigensolver

<https://www.mathworks.com/products/quantum-computing.html>

<https://www.mathworks.com/help/matlab/math/introduction-to-quantum-computing.html>

<https://www.mathworks.com/academia/books/introductory-quantum-mechanics-with-matlab-chelikowsky.html>

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