

Integrating Experimental Photonics with MATLAB :



Mehmet Bütün
Bilkent University
mehmet.butun@bilkent.edu.tr

Experimental study of photonics

Utilization of electro-mechanical/optical tools with synchronization

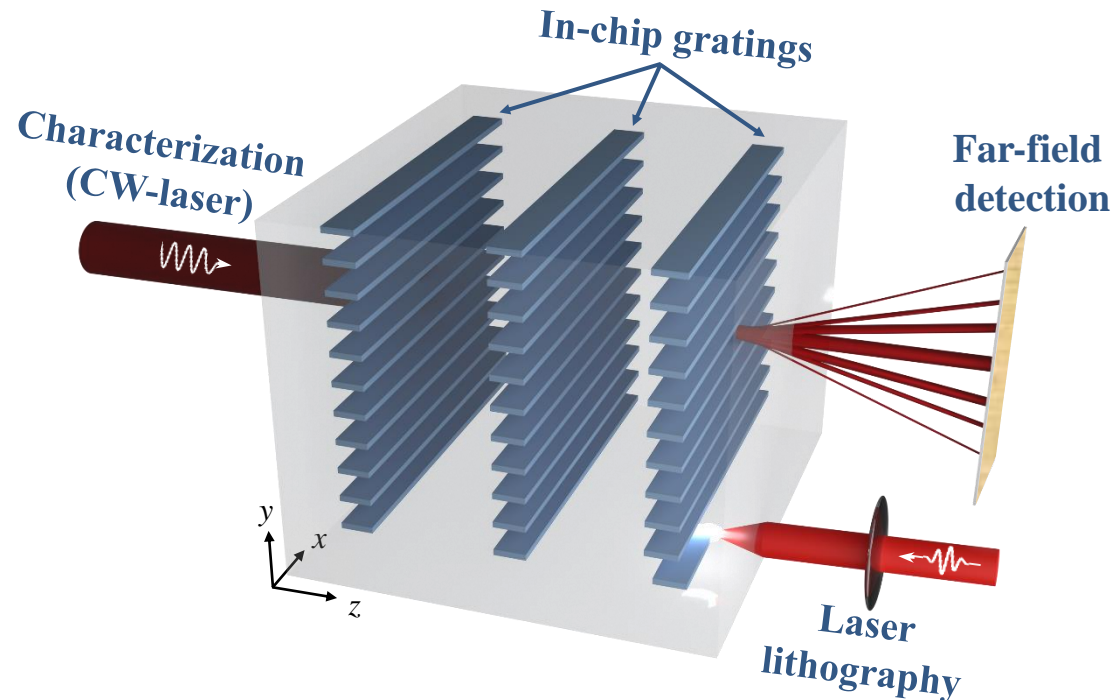
- Electronic stages (motion in x-y-z axes)
- Spatial Light Modulators
- Cameras
- Powermeters

- Control of optical devices with synchronization
- Safety protocols and protection of the equipment

Electro-mechanic/optic device control

Controlling devices in the Lab environment

- High-power laser beams are controlled with electromechanical and electro-optical devices.
- High precision in the x-y-z axis is used for laser writing in the bulk of silicon.



We need to synchronize electronic devices used throughout the process, from laser writing to characterizing optical devices.

Electro-mechanic/optic device control

Hazard control

- Optical devices such as lenses, electronic stages, and electro-optic devices can be expensive. However, the programming tools available for optical devices are not user-friendly and may not be applicable to many use cases.
- High-power lasers can cause harm to users or equipment if not used properly.
- Laser writing poses challenges for researchers in handling hazards and controlling equipment efficiently.
- As a solution to all, MATLAB provides various tools for controlling the laboratory's lasers and laser guiding systems.

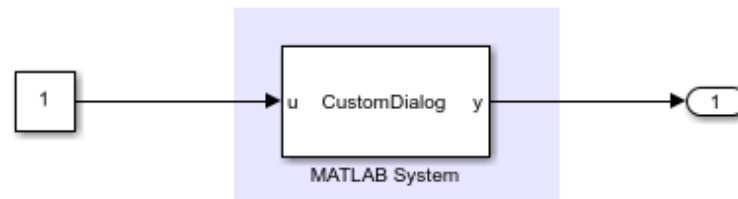
Electro-mechanic/optic device control

Simplifying code work and reducing hazards with MATLAB

- In academia, MATLAB is a widely used programming language, but especially with Simulink's graphical blocks coding and learning simplified.
- Utilizing Simulink ensures safety by preventing laser beams from deviating too much from the optical axis and electromechanical devices from touching optical components.
- Lengthy codes with hundreds of lines can be challenging to understand and prone to errors by new lab users.

Active control of the laser beams

- Matlab is utilized to shape Laser beams by creating necessary patterns on Spatial Light Modulators (SLM).
- The shaped beam types are actively controlled and synchronized with the electronic stages such that the laser-written areas are modified as desired.
- Potential hazards of synchronized motion of multiple devices are eliminated by utilizing clearly indicated custom block dialogs in Simulink.



Copyright 2018 The MathWorks, Inc.

Results obtained and personal considerations

- Graphical interface and blocks in coding are helpful for testing and understanding code output. New users benefit from its ease of use.
- Clear algorithms in graphical custom block dialogs are actively used to implement safety measures for lasers, electromechanical, and electrooptical devices to prevent potential harm.

Future plans

In recent years, undergraduate students have become increasingly involved in advanced research in laboratories.

- Simulink can be used to program electronic laboratory equipment, creating safer algorithms for both students and equipment during experiments.

Thank you

Q&A – 5min

Mehmet Bütün
Bilkent University
mehmet.butun@bilkent.edu.tr

