An introduction to MATLAB

Shiva Kumar Gaddam (MM22D014)

10 July 2024

Laboratory for Mechanics of Microstructures, Dept. of MME, IIT Madras

Table of contents

Introduction

Introduction

What is MATLAB?

- A ***high-level***, ***scientific*** programming language (built-in support for matrices, matrix arithmetic and mathematical optimisation).
- MATrix LABoratory - started as a simple matrix calculator
- Popular among the scientific community - quick and simple
- For beginners - an upgrade from Excel and much more

Why MATLAB?

- Easy to learn and easy to use
- Well-written documentation and discussion forums
- Interactive environment, comprehensive library and toolboxes.

Introduction

How is MATLAB useful for a (research) student?

- Implementation or testing of numerical methods.
- Prototyping, testing and understanding algorithms - often as an intermediate step in developing programs using low-level languages (Fortran or C)
- Visualisation (and manipulation) of data — plotting
- Developing applications(a bit advanced)
-

Today's session

- A jump-start

Interface overview

Interface overview

- License and registration
- Interface
  - Command window and command history
  - Editor
  - Workspace
  - Current folder
  - Menu ribbon
  - basic commands: `clear`, `clc`, `doc`, `disp`

Basics of programming

Basics of programming

- Variables and Fundamental data types
- Arithmetic operations
- Loops and conditionals
- Functions (and classes)
- Data structures
  - Arrays
  - Cell Arrays
  - Structure Arrays

Matrix Operations and Linear Algebra

Matrix operations and Linear Algebra

- Arithmetic operations
- Element-wise operations
- Determinant and inverse
- Eigenvalues and eigenvectors
- Solving system of equations $Ax = b$
  - By calculating the inverse of A
  - By calculating the LU decomposition of A
- Some useful functions: `min,max,sum,find,<,>`

Visualisation and Plots

Plotting

- an example

Visualisation of fields

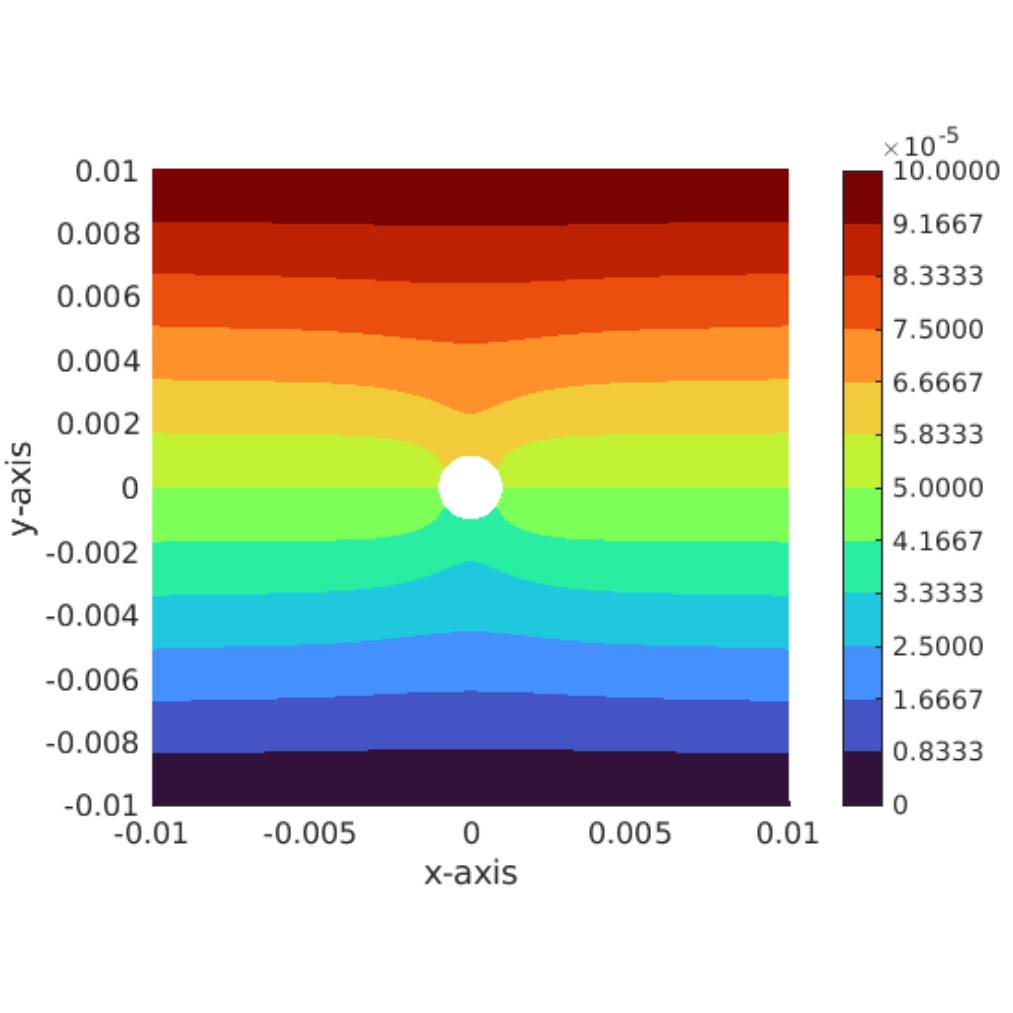

Figure 1: Vertical displacement of a plate with hole subjected to uniaxial tension

Visualisation of fields

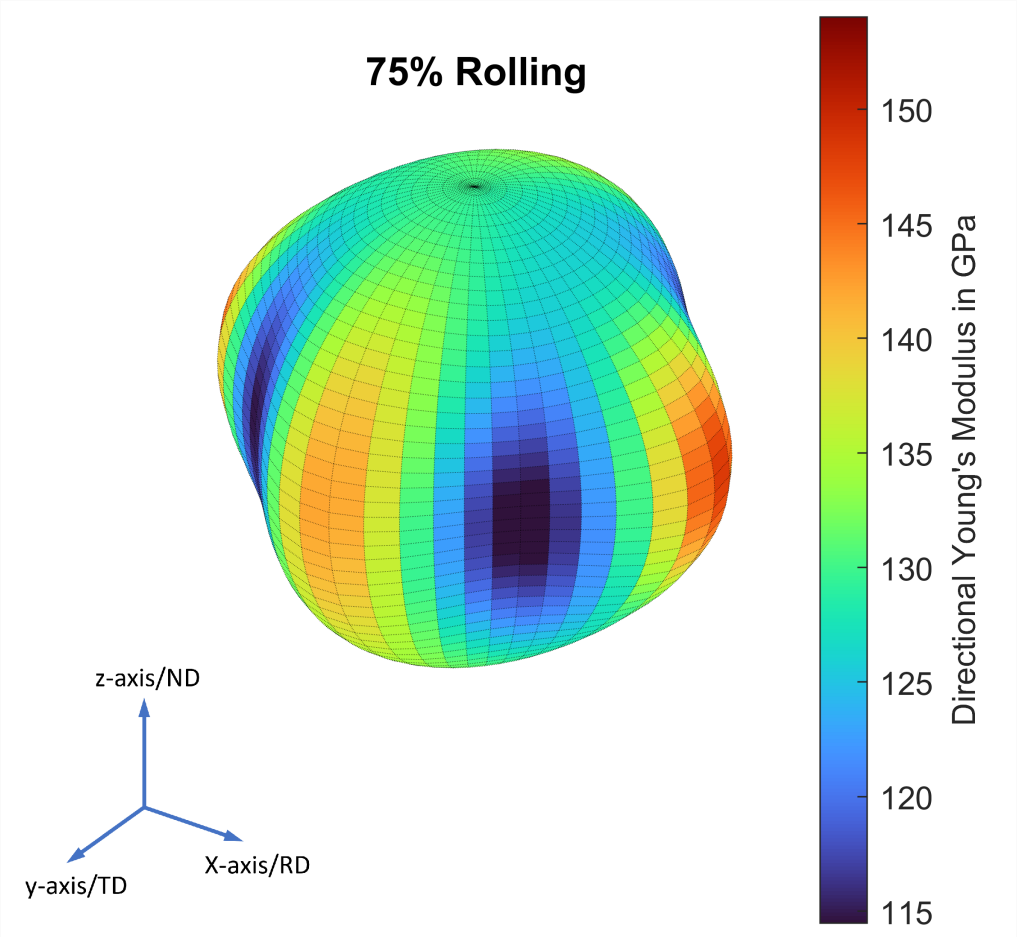

Figure 2: Elastic anisotropy of a Copper polycrystal subjected to 75% rolling

Additional concepts

Additional concepts

1. `.mat` files: `save(filename),load(filename)`
2. parallel computing toolbox – parallelise for loops

Conclusion

Conclusion

"more science and less programming"

- **Recommended programming languages**: Fortran and Julia
- **A short course**: MATLAB Onramp (2 hours) - `https://matlabacademy.mathworks.com`
- **LaTeX course**: edx IIT Bombay course - `https://www.edx.org`

Github repository: `https://github.com/shivakumargaddam`

Questions?