Introduction to MATLAB for Data Analysis and Programming

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Agenda

- Bring data into the MATLAB environment
- Explore and visualise data using interactive tools
- Use MATLAB’s high level language to automate data analysis and create reports
Data Analysis Tasks

Access
- Files
- Software
- Hardware

Explore & Discover
- Data Analysis & Modeling
- Algorithm Development
- Application Development

Share
- Reporting and Documentation
- Outputs for Design
- Deployment

Automate
Demo: Solar Radiation Estimation

Introduction to MATLAB

- **Goal:**
  - Estimate daily mean global solar radiation given low cost and easily obtained measurements

- **Approach:**
  - Process historical measurements
  - Develop and test predictive model
  - Document analysis in a report
Modelling Global Solar Radiation

\[ R_s = a \left(1 + bH\right) \left(1 - e^{-c \Delta T^n}\right) \]

- \( R_s \): Solar Ratio (global solar radiation/ extraterrestrial solar radiation)
- \( H \): Relative humidity
- \( \Delta T \): \( T_{\text{DailyMax}} - T_{\text{DailyMin}} \)
- \( a, b, c, n \): Model coefficients

- Value of extraterrestrial solar radiation is calculated for a given day-of-year (ordinal date) and latitude using a known formula
- Daily temperature variations are largely driven by solar radiation received at the surface
Demo: Solar Radiation Estimation

Explore & Discover

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Algorithm Development

Application Development

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Automate

Products Used
- MATLAB
- Curve Fitting Toolbox

Code & Applications

MATLAB
CDF
.NET
Excel
C/C++
Java
.dll
Accessing Data from MATLAB

Access

- Files
  - Excel, text, or binary
  - Audio and video, image
  - Scientific formats and XML

- Applications and languages
  - C/C++, Java, FORTRAN
  - COM, .NET, shared libraries
  - Databases *(Database Toolbox)*

- Measurement hardware
  - Data acquisition hardware *(Data Acquisition Toolbox)*
  - Stand-alone instruments and devices *(Instrument Control Toolbox)*
Data Analysis and Visualization in MATLAB

- Built-in engineering and mathematical functions
  - Interpolation, filtering, smoothing, Fourier analysis

- Extensive plotting capabilities
  - 2-D, 3-D, and volume visualization
  - Interactive tools for creating custom plots
Sharing Results from MATLAB

- Automatically generate reports
  - Publish MATLAB files
  - Customize reports using MATLAB Report Generator

- Package as an app

- Deploy applications to other environments
Summary

- High level programming language for technical computing

- Facilitates rapid, iterative data analysis

- Interactive tools for data exploration and MATLAB code generation