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

Access
- Files

Explore & Discover
- Data Analysis & Modeling
- Algorithm Development
  ```matlab
  for k=1:max
  x = fft(dat)
  y = 20*log1
  end
  ```

Application Development
- Option 1
- Option 2

Share
- Reporting and Documentation
- Outputs for Design

Automate
- Software
- Hardware
- Code & Applications

Products Used
- MATLAB
- Curve Fitting Toolbox

Code & Applications
- MATLAB
- Curve Fitting Toolbox
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