**Professional Development Session: Data Analysis using MATLAB for Engineering**

**Target Audience:** Freshman Engineering Students  
**Duration:** 1 hour  
**Tools Needed:** MATLAB (installed on lab computers or your laptop), Projector  
**Files Needed:** **sensor\_data.csv** (provided below)

**Session Script**

**1. Introduction (5 minutes)**

**You:**  
"Good [morning/afternoon], everyone! My name is [Your Name], and today, we’re diving into **Data Analysis using MATLAB**, specifically focusing on **engineering applications**. Whether you’re working with sensor data, designing aerospace components, or analyzing mechanical systems, MATLAB is a powerful tool that engineers rely on every day."

"Before we get started, let me ask a quick question: **How many of you have used MATLAB before?**"  
*(Pause for hands to go up.)*

* If most students haven’t used MATLAB:  
  "No worries! Today, we’ll start from the basics and make sure everyone can follow along."
* If many have:  
  "Great! We’ll build on what you know and apply it to real engineering data."

**You:**  
"By the end of this session, you will:

1. Learn how to **import and explore data** in MATLAB.
2. Create **visualizations** to understand engineering trends.
3. Perform **basic statistical analysis** to make sense of engineering data.
4. Write **functions** to automate simple tasks."

"Let’s get started!"

**2. Understanding the MATLAB Environment (5 minutes)**

**You:**  
"First, let’s take a quick look at MATLAB’s interface."

(Show MATLAB on the projector. Open MATLAB.)

"When you open MATLAB, you’ll see a few key areas:"

* **Command Window**: Where you type commands.
* **Workspace**: Where MATLAB stores your variables.
* **Editor**: For writing scripts.
* **Current Folder**: Where your files are located.

**Ask the students:**  
"Have any of you used Python or Excel for data analysis? How does MATLAB compare so far?"

*(Wait for a response.)*

"Alright, now let’s load some engineering data!"

**3. Importing Engineering Data (10 minutes)**

**You:**  
"In engineering, we often collect data from sensors. Let’s say we have data from a temperature sensor inside a jet engine, recorded over time. We’ll use a sample dataset called **sensor\_data.csv**."

**Mock Dataset: sensor\_data.csv**

(Save this CSV file and provide it to students.)

Time (s), Temperature (°C), Pressure (kPa), Vibration (m/s^2)

0, 25.1, 101.2, 0.02

1, 25.3, 101.1, 0.03

2, 25.5, 101.0, 0.04

3, 25.7, 100.9, 0.03

4, 26.0, 100.7, 0.05

5, 26.5, 100.5, 0.06

**Importing the Data in MATLAB**

data = readtable('sensor\_data.csv');

head(data)

**Ask students:**  
"What do you notice about the dataset? What are the columns representing?"  
*(Wait for a response.)*

**4. Data Visualization: Understanding Sensor Trends (15 minutes)**

**Line Plot: Temperature Over Time**

plot(data.Time, data.Temperature, 'r-o', 'LineWidth', 2);

xlabel('Time (s)');

ylabel('Temperature (°C)');

title('Temperature Variation Over Time');

grid on;

**Ask students:**  
"What trend do you see? What happens to the temperature over time?"

**Scatter Plot: Temperature vs. Pressure**

scatter(data.Temperature, data.Pressure, 'b', 'filled');

xlabel('Temperature (°C)');

ylabel('Pressure (kPa)');

title('Temperature vs. Pressure');

grid on;

**Ask students:**  
"Does this look like a linear relationship? What do you think might cause pressure to decrease as temperature rises?"

**5. Statistical Analysis: Identifying Trends (10 minutes)**

mean\_temp = mean(data.Temperature);

std\_temp = std(data.Temperature);

max\_temp = max(data.Temperature);

min\_temp = min(data.Temperature);

**Ask students:**  
"Why might an engineer want to find the max/min values in sensor data?"

**6. Hands-On Exercise: Data Exploration (10 minutes)**

**You:**  
"Now it’s your turn! Try the following tasks in MATLAB:"

1. **Calculate the mean and standard deviation** of the **Pressure** column.
2. **Plot a line graph** of **Vibration vs. Time**.
3. **Find the time step** where the highest **Temperature** was recorded.

mean\_pressure = mean(data.Pressure);

std\_pressure = std(data.Pressure);

plot(data.Time, data.Vibration, 'g-o', 'LineWidth', 2);

xlabel('Time (s)');

ylabel('Vibration (m/s^2)');

title('Vibration Over Time');

grid on;

[max\_temp, max\_index] = max(data.Temperature);

time\_max\_temp = data.Time(max\_index);

**7. Writing a Function: Celsius to Fahrenheit Conversion (5 minutes)**

**You:**  
"One of the most useful things in MATLAB is writing your own functions. Let’s create a function that converts Celsius to Fahrenheit."

function F = celsius\_to\_fahrenheit(C)

F = (C \* 9/5) + 32;

end

**Example Usage:**

celsius\_to\_fahrenheit(25)

**Ask students:**  
"Why is writing functions useful in engineering applications?"

**8. Wrap-Up and Q&A (5 minutes)**

**You:**  
"Great job, everyone! Today, we learned how to:"  
✅ **Import data** into MATLAB  
✅ **Visualize trends** using plots  
✅ **Analyze engineering data** with statistics  
✅ **Write a MATLAB function** to automate calculations

"How do you see MATLAB helping you in your future engineering courses?"

**You:**  
"Thank you for joining today’s session! Keep exploring MATLAB and have fun with data analysis!"

**Files to Provide Students:**

1. **sensor\_data.csv** (sample dataset)
2. **MATLAB script file** (data\_analysis\_script.m) containing all the code from today’s session