

Electrical Engineering through Modern Tool: An OBE Approach

Part - II

MATLAB based Methodology for Teaching Technical Subjects

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Contents

Characteristics of 21st Century Teacher & Engineering Education

Role of Modern Tools in Learning Electrical Engineering

Examples from Subjects: “Control Systems” & “Electrical Measurements and Measuring Instruments”

Effect of using Modern Tools & Mapping them to Graduate Learning Attributes

Characteristics of a 21st Century Teacher

Student
Centric
Classroom

Digital
Presence

Project
based
learning

Use of
Technology

Innovate

Learning
and
adapting

Use of Modern Tools

Engineering Education

- Understanding of technical concept with practical understanding is highly relevant.
- Based on practice minimums gained in labs during the university education.

Engineering Education

- The cost and comprehensiveness of the lab equipment has increased in the past few years.

Role of Modern Tools in Engineering Education

Turns a regular PC into a
Virtual Lab.

Balance between virtual and
real labs,

- Optimize cost problems,
- Enough practice for graduating engineers

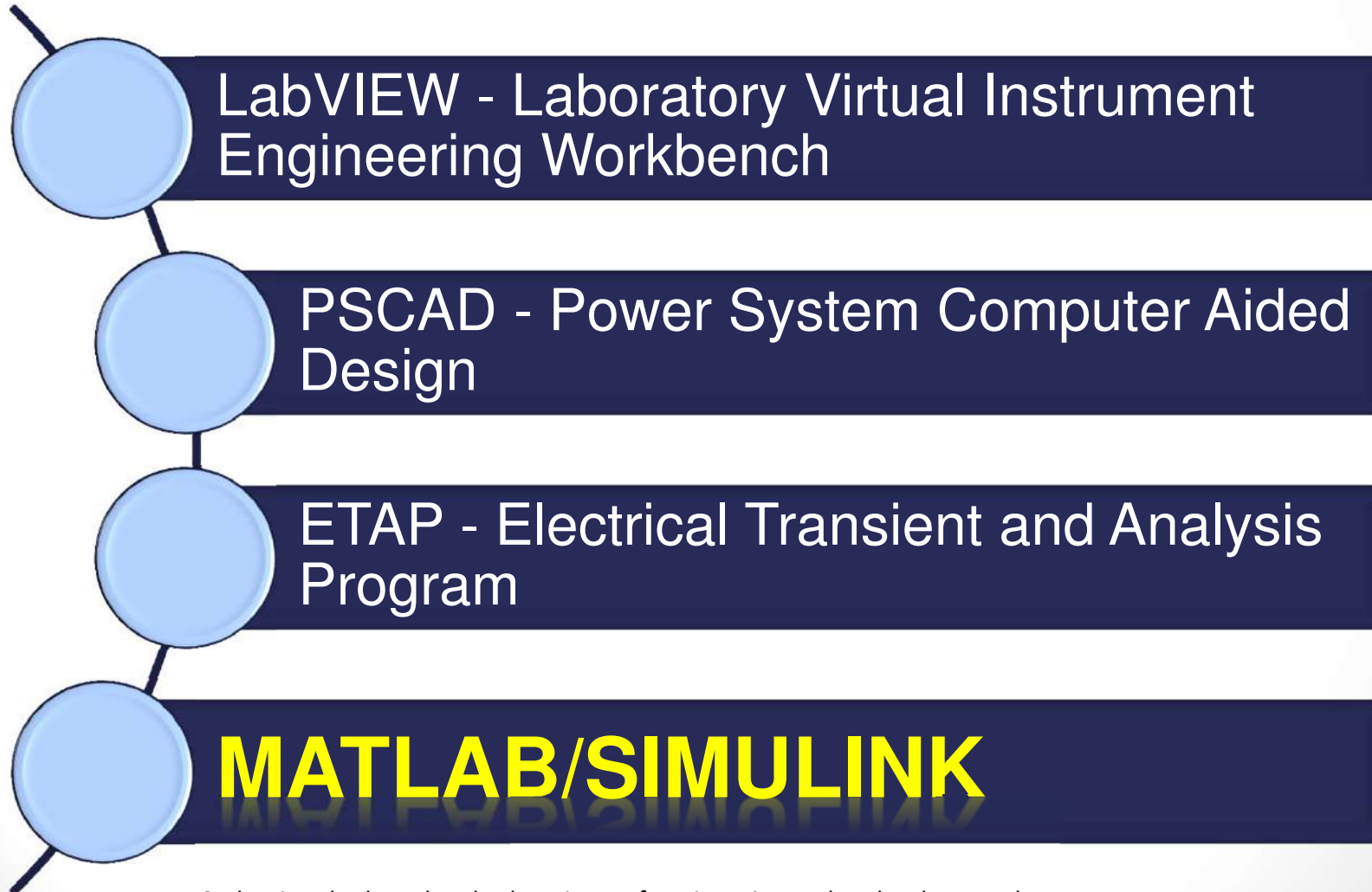
Learning through Modern Tools

The use of modern tools **enhances the understanding** of concepts.

Virtual experiments are better equipped to understand due to use of

- Mathematical expressions
- Graphics, effectively.

Modern Tools in Electrical Engineering



MATLAB[®] / Simulink[®]

- **MATLAB** (Matrix Laboratory) is a multi-paradigm numerical computing environment.
- **Simulink** is a graphical programming environment for modelling, simulating and analysing multi-domain dynamic systems.

® Mathworks

Create Learning Tool using MATLAB

Develop the model for the problem and build a Graphical User Interface (GUI) for it in MATLAB.

Create a self-extracting package for the GUI using “deploytool”.

Distribute the package to the students.

Steps for Teacher

Create Learning Tool using MATLAB

Load MATLAB
Runtime
Environment
(Freely available)

Double-click the
self-extracting
package.

Experiment &
Learn

Steps for Student

Example #1

Control Systems

- Systems and their representation
- Time Response Analysis
- Frequency Response Analysis
- Stability of Control System

Syllabus Contents

Example #1

Control Systems

Learning Outcomes:



Understanding of the fundamentals of control systems.



Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.



Determine the time and frequency-domain responses of systems to various inputs.



Determine the stability of a closed-loop control system



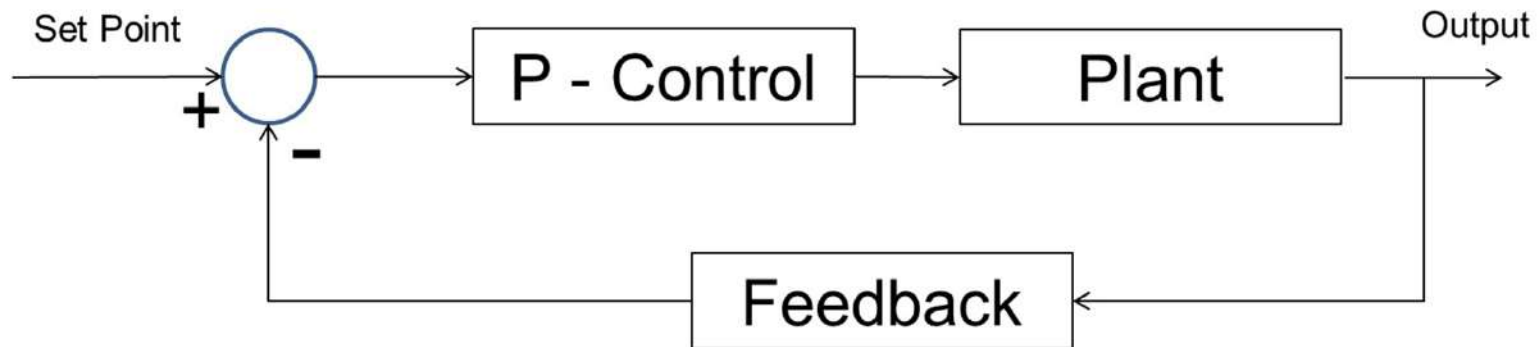
Example #1

Control Systems

Time
Response
Analysis

**P, PI, PID
MODES**

P-Control Problem



- $K_P = \text{Variable Gain}$
- $\text{Plant} = \frac{1}{(s^2 + 10s)}$
- $\text{Feedback} = 1$
- $\text{Transfer Function} = \frac{K_P}{(s^2 + 10s + K_P)}$

P-Control Problem

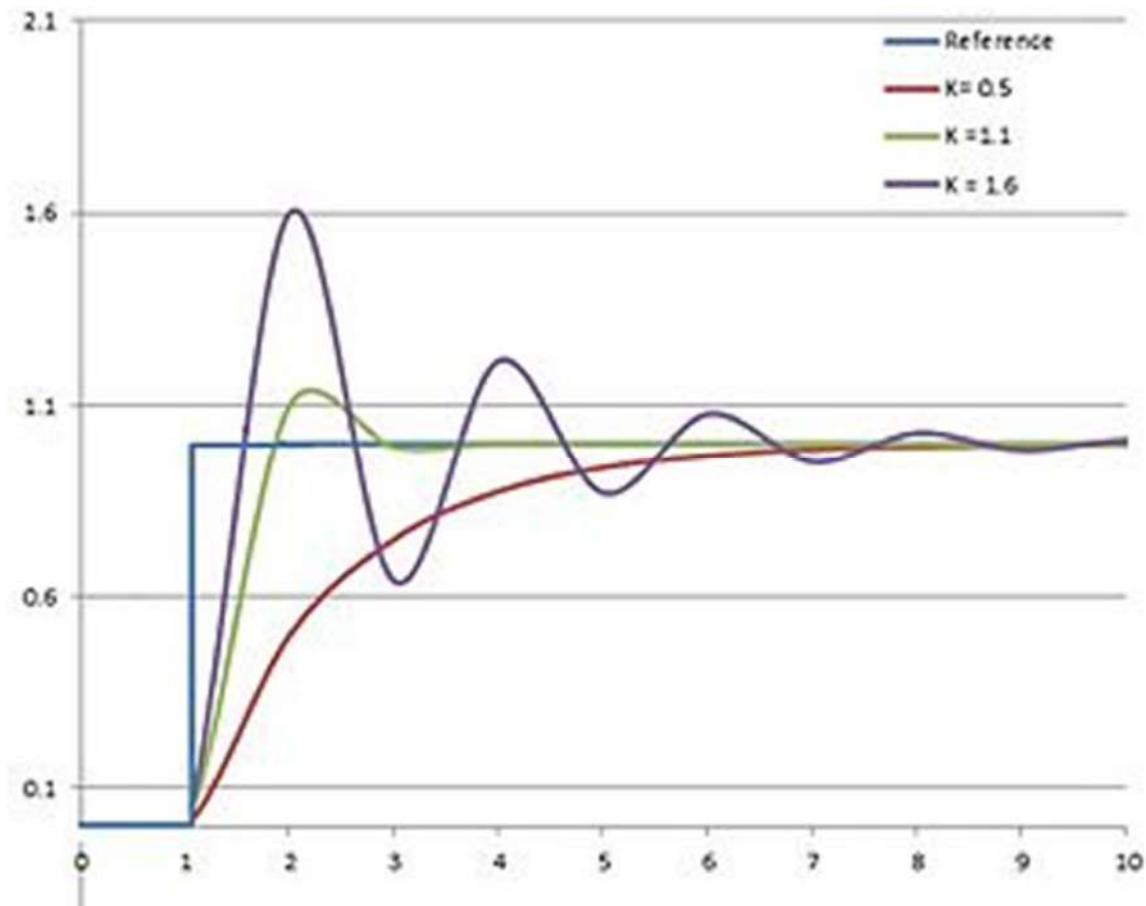


Image from Wikipedia



Demo

Understanding P - mode of Feedback Control

Example #2

Electrical Measurements & Measuring Instruments

- Units, Standards & Errors, Measuring System Fundamentals
- Measuring Instruments
- Wattmeters & Energy Meters, Power Factor & Frequency Meters
- Low & High Resistance Measurements, A.C. Bridges

Syllabus Contents

Example #2

Electrical Measurements & Measuring Instruments

Learning Outcomes:



Understand the units and standards followed in the industry



Gain knowledge of fundamentals of measuring instruments



Understanding working and functions of equipment used for measuring electrical quantities



Understand the basics of resistance measurements and bridge – based measurements



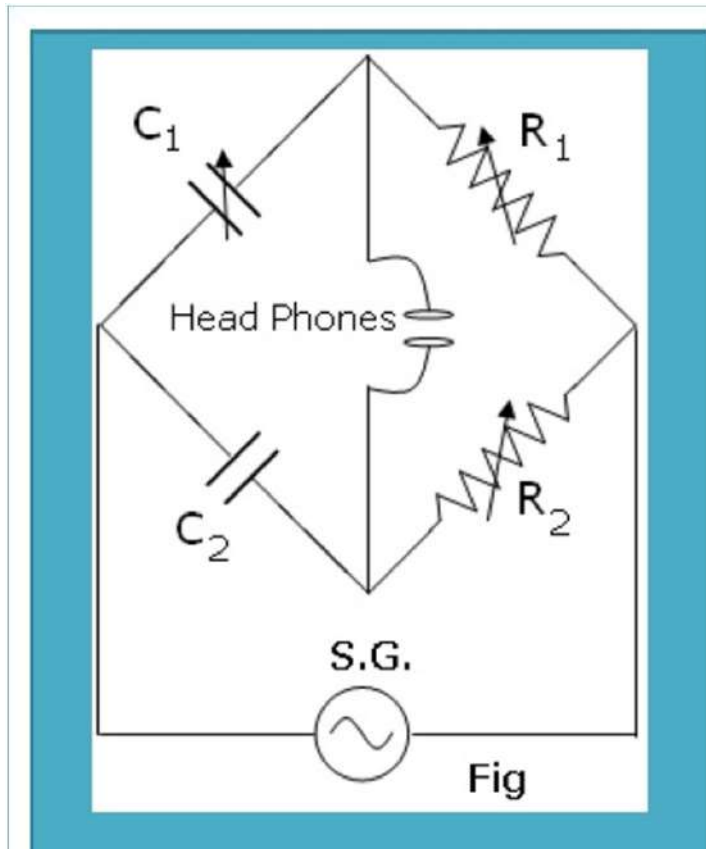
Example #2

Electrical Measurements & Measuring Instruments

Low & High
Resistance
Measurements,
A.C. Bridges

**A.C.
BRIDGES**

De-Sauty's Bridge



- $C_1 = C_2 \times \frac{R_2}{R_1}$

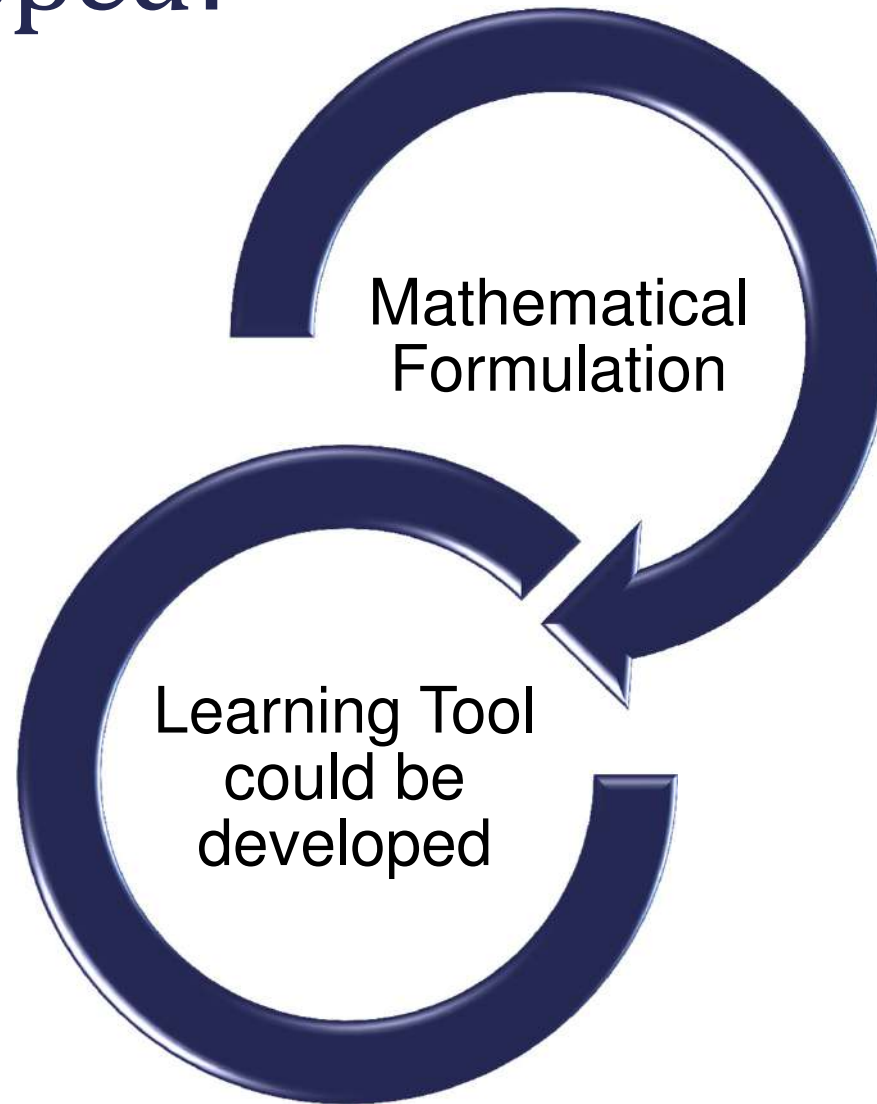
Image from www.electrical4u.com




Demo

Understanding De-Sauty's Bridge

For which concept tool could be developed?



Effect of Modern Tools



Enhances the involvement of the students in learning process.

Improves students' understanding of the concept.

Students get enough practice that is required and is relevant for engineering

Students are able to test the learning of technical concepts.

Graduate Learning Attributes



- Engineering Knowledge



- Problem Analysis



- Design and development of solution



- Modern Tool usage

Conclusion

Outcome based education is important to make our education system valuable in real terms.

This requires teachers from technical education to deliver content through innovative practices and with the use of modern technology & tools to achieve the course outcome.

Through this webinar, we have demonstrated the use of MATLAB as modern tool for the achievement of the graduate attributes.

References

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Thank You.

Queries and Discussion

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