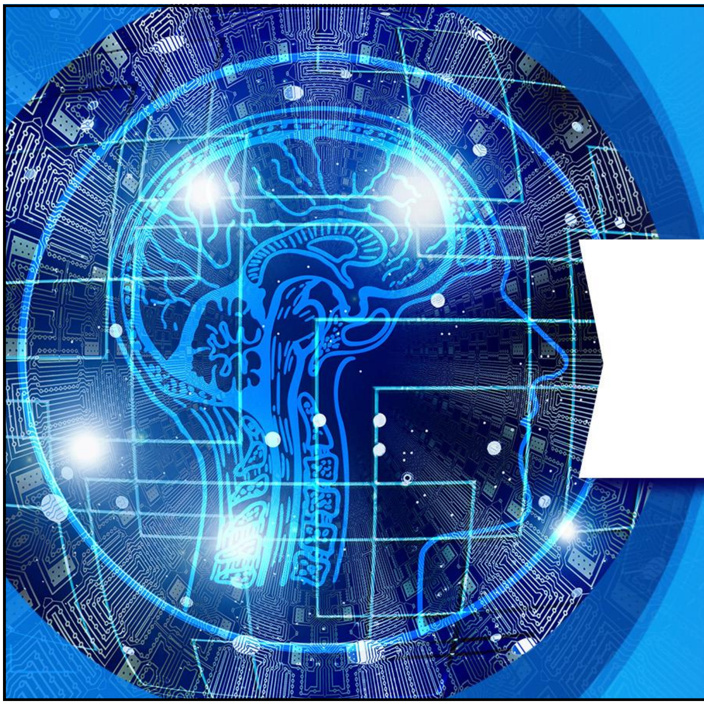

GET201 PART II

Engr. Dr. Olalekan Ogunbiyi

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Course Outline

- DC/AC Bridges: Resistance, Capacitance and Inductance Measurement
- Transducers
- Single Phase Circuits
- Complex J - Notation
- AC Circuits
- Impedance
- Admittance
- Susceptance

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Textbooks

- J. A. Svobod and R. C. Dorf, Introduction to Electric Circuits, 9th Edition, Wiley.
- William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, Eighth Edition, McGraw-Hill.
- C. K. Alexander and Matthew N. O. Sadiku, Fundamentals of Electric Circuits.

DC/AC Bridges

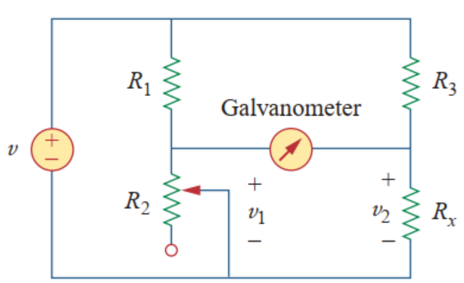
- Bridge circuits are used very commonly as a variable conversion element in measurement systems and produce an output in the form of a voltage level that changes as the measured physical quantity changes.
- They provide an accurate method of measuring resistance, inductance and capacitance values, and enable the detection of very small changes in these quantities about a nominal value.
- They are of immense importance in measurement system technology because so many transducers measuring physical quantities have an output that is expressed as a change in resistance, inductance or capacitance.

Resistance Measurement

- Although the ohmmeter method provides the simplest way to measure resistance, more accurate measurement may be obtained using the Wheatstone bridge.
- While ohmmeters are designed to measure resistance in low, mid, or high range, a Wheatstone bridge is used to measure resistance in the mid range, say, between 1Ω and 1MΩ
- Very low values of resistances are measured with a milliohmmeter, while very high values are measured with a Megger tester.

Wheatstone bridge

The Wheatstone bridge (or resistance bridge) circuit is used in a number of applications. Here we will use it to measure an unknown resistance.



$$v_1 = \frac{R_2}{R_1 + R_2} v = v_2 = \frac{R_x}{R_3 + R_x} v$$

$$\frac{R_2}{R_1 + R_2} = \frac{R_x}{R_3 + R_x} \quad \Rightarrow \quad R_2 R_3 = R_1 R_x$$

$$R_x = \frac{R_3}{R_1} R_2$$

If $R_1 = R_3$, and R_2 is adjusted until no current flows through the galvanometer, then $R_x = R_2$.

Example 1.
Consider a balanced DC Wheatstone bridge with R_1=500Ω and R_3=200 Ω. Det. The unknown resistance when R_2=125 Ω.

Example 2.
A Wheatstone bridge has R_1=R_3=1k Ω. R_2 is adjusted until no current flows through the galvanometer. At that point, R_2=3.2k Ω. What is the value of the unknown resistance? And=3.2k Ω

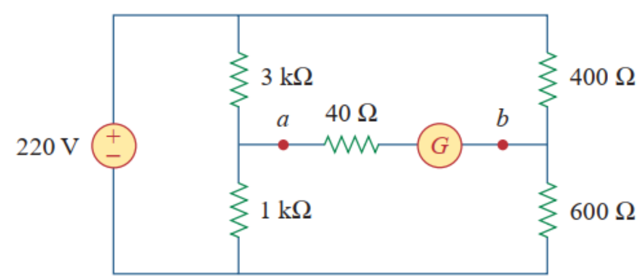
Unbalanced Wheatstone Bridge

To find the current through the galvanometer when the Wheatstone bridge is *unbalanced*?

Find the Thevenin equivalent (V_{th} and R_{th}) with respect to the galvanometer terminals. If R_m is the resistance of the galvanometer, the current through it under the unbalanced condition is:

$$I = \frac{V_{\text{Th}}}{R_{\text{Th}} + R_m}$$

Example 3
The circuit below represents an unbalanced bridge. If the galvanometer has a resistance of 40 Ω, find the current through the galvanometer.



AC Bridges

- Maxwell's Inductance Bridge
- Maxwell-Wien Bridge
- Anderson Brdige
- Hay's Bridge
- Owen Bridge
- Heaviside Compbell Equal Ratio Bridge
- Capacitance bridge
- Schering Bridge
- Wien Bridge (Series/Parallel)

Thank You