EAST WEST UNIVERSITY
Department of EEE

Section: 01
Course Code: EEE304
Course Name: Electrical Power Systems

Course Instructor's Name: Dr. Khalid Imtiaz Saad (DKIS)
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OPEN ENDED EXPERIMENT

Experiment Name: Verification of the Surge Impedance Loading Theorem
Performance Date: 28 August, 2023

Submitted By

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OBJECTIVE

The primary aim of this open-ended experimental investigation is twofold:

1. Formulating an experimental setup to validate the Surge Impedance Loading (SIL) Theorem.
2. Empirically confirming the Surge Impedance Loading (SIL) Theorem.

THEORY REVIEW

When a transmission line is loaded by being terminated with an impedance equal to its
characteristic impedance, the receiving end current is,

$$I_R = \frac{V_R}{Z_C} \quad \text{————(i)}$$

For a lossless line, Z_C is purely resistive, known as surge impedance.

If a lossless line is terminated being loaded with an impedance equal to its surge impedance, voltage and current at any point in the line are as follows:

$$V_S = V_R \cos\beta x + jV_R \sin\beta x = V_R \angle \beta x \quad \text{————(ii)}$$

$$I_S = jI_R \sin\beta x + I_R \cos\beta x = I_R \angle \beta x \quad \text{————(iii)}$$

From the above equations, it is observed that the magnitude of the voltage and current at any point in the line remains unchanged. Also, the angles of the voltage and current are linearly proportional to the distance from the receiving end.

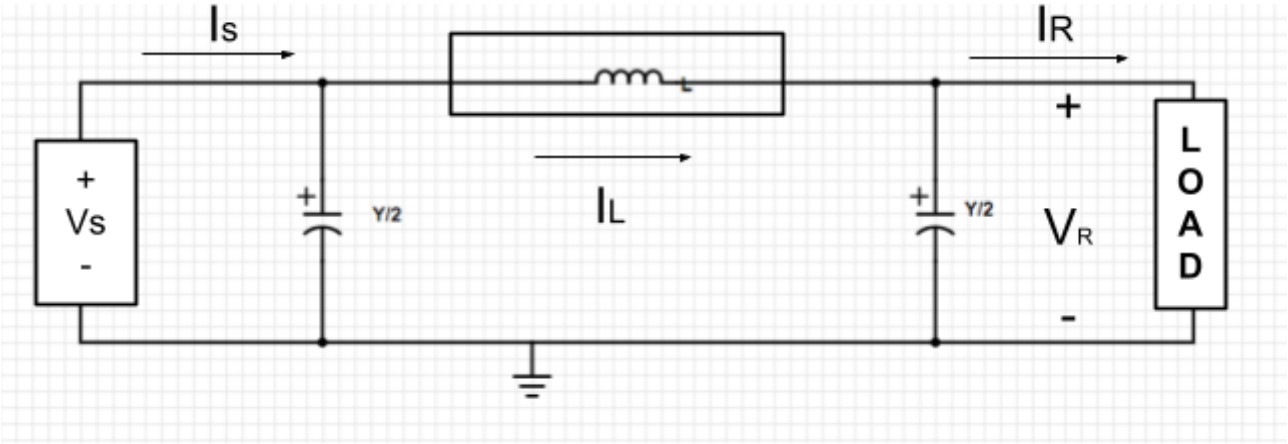

Figure 01: Per-phase equivalent circuit

EQUIPMENT LIST

1. IT-6000 – three phase variable power supply.
2. IT-6002 – line model.
3. IT-6004 – resistive load.
4. IT-6005 – inductive load.
5. IT-6035 – moving coil ammeter.
6. IT-6038 – moving iron voltmeter.

PRELAB WORKS

Complete the following tasks before the experiment day and fill up the appropriate columns of Table 2 in the datasheet. Also, have the detailed calculations checked by the instructor.

- Theoretically measuring the sending end voltage, receiving end voltage, sending end current, receiving end current.
- Use eqns. (i), (ii), (iii) to measure the sending end voltage, receiving end voltage, sending end current and receiving end current.
- Fill up the appropriate columns of Table 2 in the datasheet.

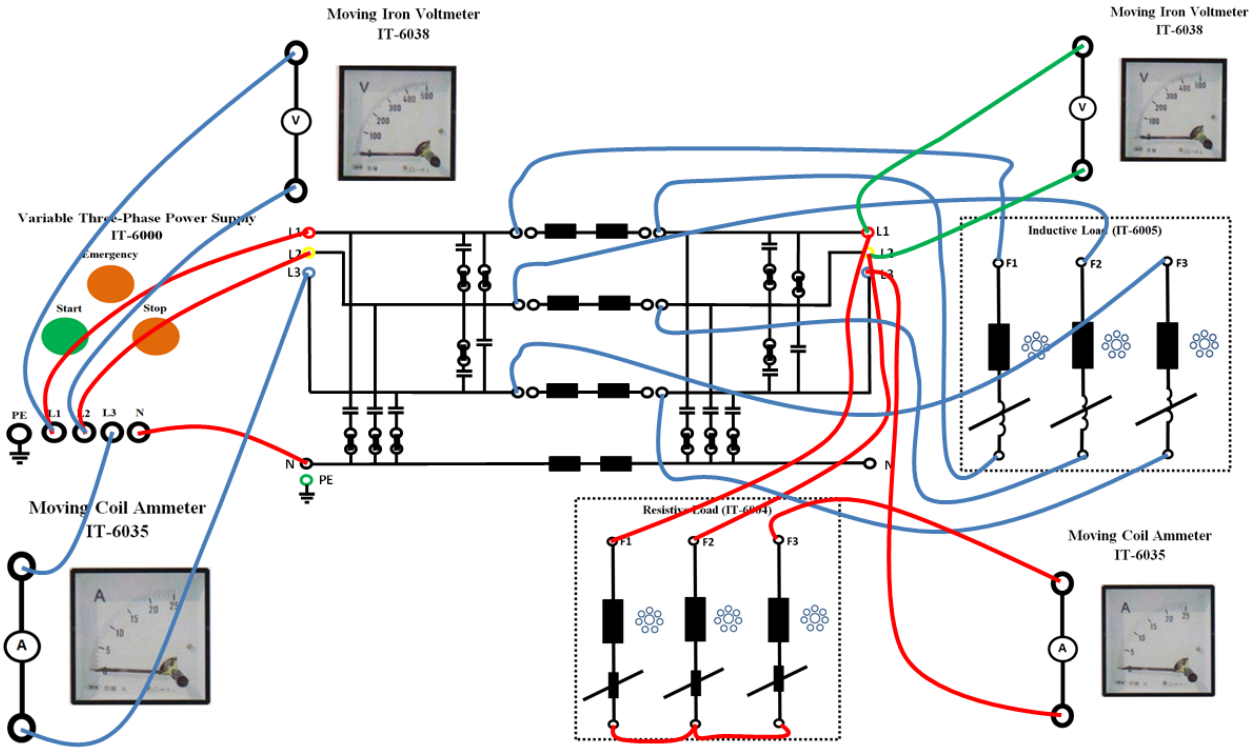

***Figure 02*:** Connection diagram of open ended experiment for resistive loads

PROCEDURE

1. Connect the circuit as shown in Figure 02.
2. Rotate the knobs of the three-phase inductive load to CW position to make sending end voltage and receiving end voltage equal or quite close (position 1 to 7) in all the three phases.
3. Rotate the knobs of the three-phase resistive load to their full CW position to engage maximum loads in all the three phases.
4. Turn the power of the circuit by following the proper procedure.
5. Rotate the voltage knob of the three-phase variable power supply to increase the voltage until the receiving end voltage reaches 100 V.
6. Take the readings of the voltmeters and ammeters and write in the appropriate columns of Table 1 in the attached datasheet.

REPORT

Submit a report on this experiment within the deadline announced in the class. The report should contain the following items:

1. A cover sheet containing the usual information such as your name, student ID, course code, course title, experiment no., title of the experiment, date of performance and date of submission.
2. Experimental datasheet, checked and signed by the instructor.

EXPERIMENT DATA SHEET

Experiment Name	Verification of the Surge Impedance Loading Theorem
Group No.	01
Date of Performance	28/08/2023
Signature of the Instructor	

Table 1: Comparison between theoretical results and experimental results

Load Position	***Inductive Load Impedance***	***Resistive Load Impedance***	***Sending End Voltage,*** V_S	***Receiving End Voltage,*** V_R	***Sending End current,*** I_S	***Receiving End Current,*** I_R

Table 2: Comparison between theoretical results and experimental results

Criteria	***Theoretical Value (TH)***	***Experimental Value(EV)***	***Error(%)=*** $\frac{\lvert TH-EV \rvert}{\lvert EV \rvert}$
Sending End Voltage, V_S			
Receiving End Voltage, V_R			
Sending End current, I_S			
Receiving End Current, I_R			