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Virtual Lab Experiment 2

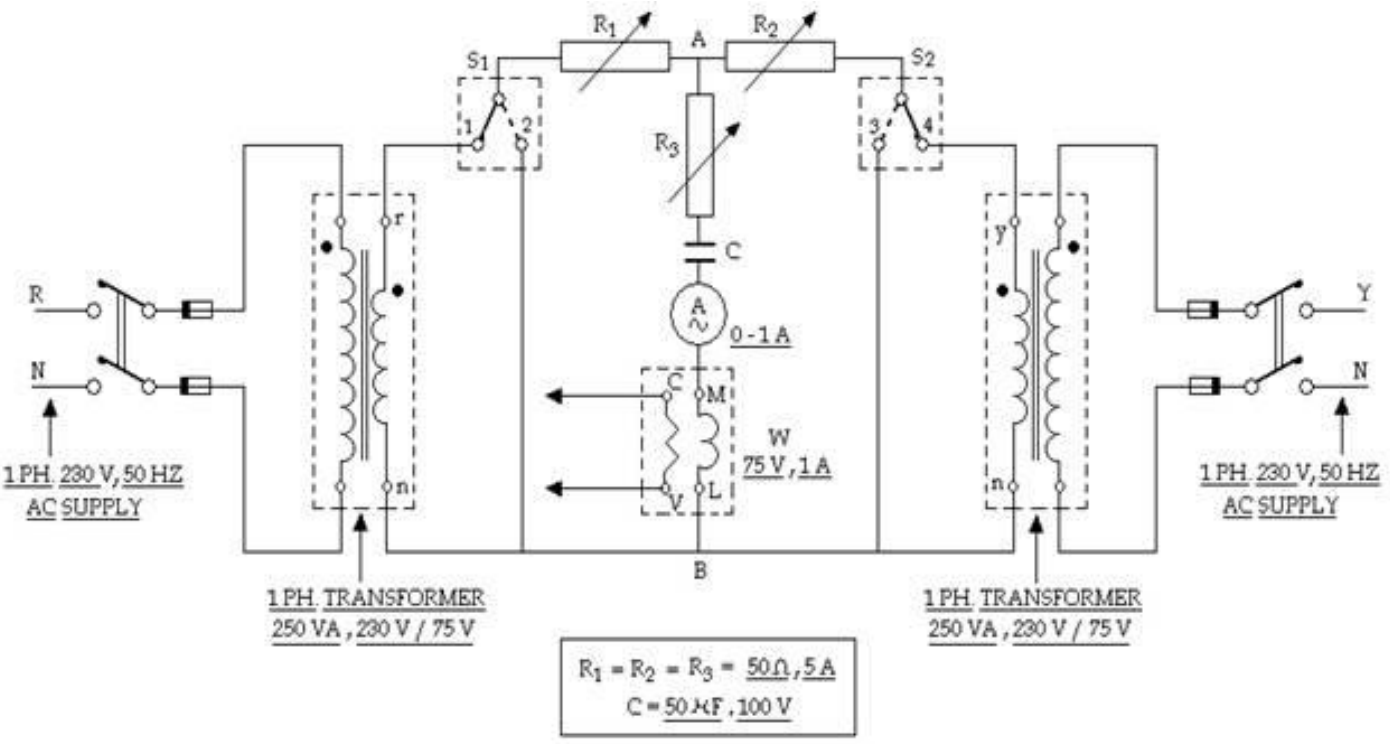
AIM : To study and verify the Superposition Theorem

THEORY : Superposition theorem states that -

"In a linear, bilateral network, consisting of several sources, the resultant current in any branch is the algebraic sum of the currents caused by the separate independent sources acting alone replacing all other sources by their respective internal resistances."

This theorem when used for evaluating response in a complicated network containing several sources, simplifies the analysis. The theorem is particularly used in case of network, where sources generating voltages or currents of different frequencies are acting simultaneously, considering the effect of individual source independent of others.

CIRCUIT DIAGRAM



a) For switch 'S_1' in position '1' and 'S_2' in position '3' , source 'r-n' is active (ON) and source 'y-n' is inactive (OFF). Wattmeter pressure coil is to be connected across 'r-n'.
b) For switch 'S_1' in position '2' and 'S_2' in position '4' , source 'y-n' is active (ON) and source 'r-n' is inactive (OFF). Wattmeter pressure coil is to be connected across 'y-n'.
c) For switch 'S_1' in position '1' and 'S_2' in position '4', both sources are active (ON). Wattmeter pressure coil is to be connected across 'r-n'.

PROCEDURE :

1. Make the connections as per the circuit diagram. Make use of the dot convention for proper connection of secondary of transformers. Secondary of two transformers acts as a voltage source.
2. Keep switch S_1 in position '1' and S_2 in position '3'.

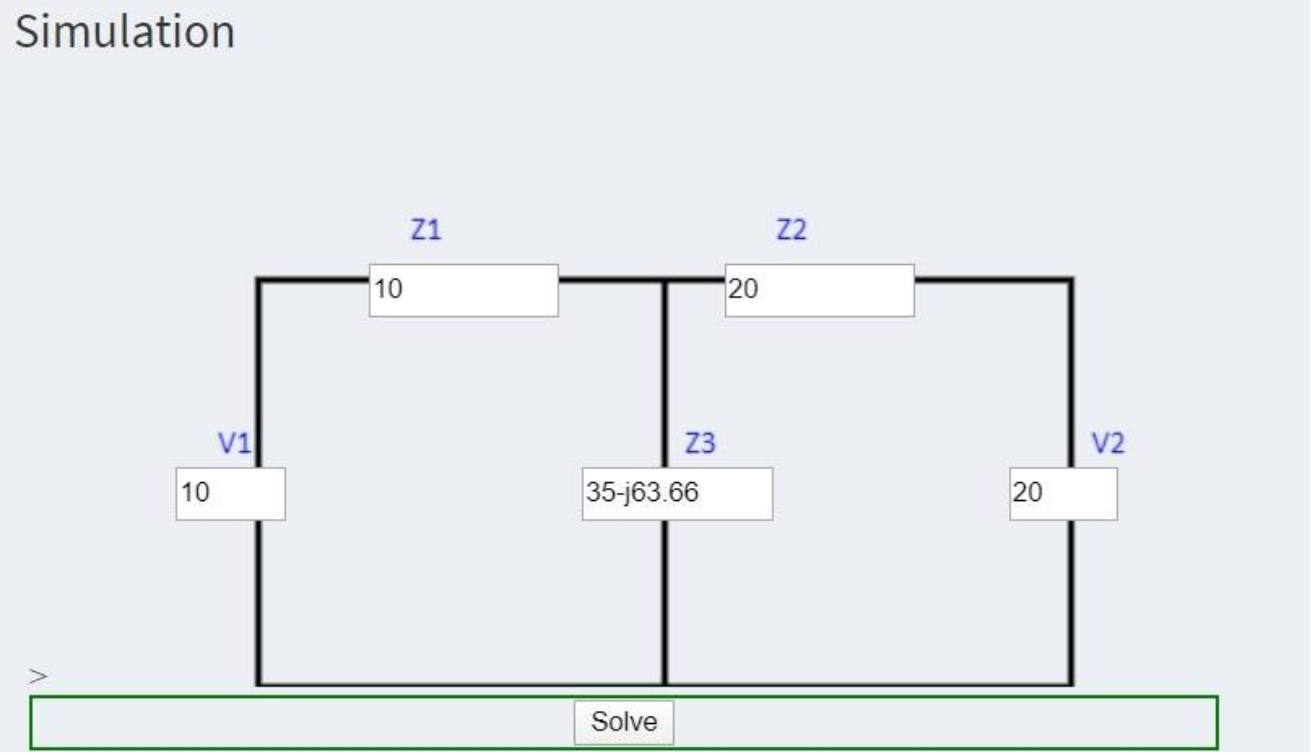
3. Note down voltage V_{rn}, V_{yn}, current through branch A-B and wattmeter reading.
4. Keep switch S_1 in position '2' and S_2 in position '4' and repeat step 3.
5. Keep switch S_1 in position '1' and S_2 in position '4' and repeat step 3.
6. Measure resistance R_1, R_2, R_3.

How to perform simulation :

1. Click on V1, enter the appropriate value.
2. Repeat the step 1 to enter the values of Z1, Z2, Z3& V2.
3. Then click on solve button.
4. The result are displaced showing the values when each source is acting.

OBSERVATIONS :

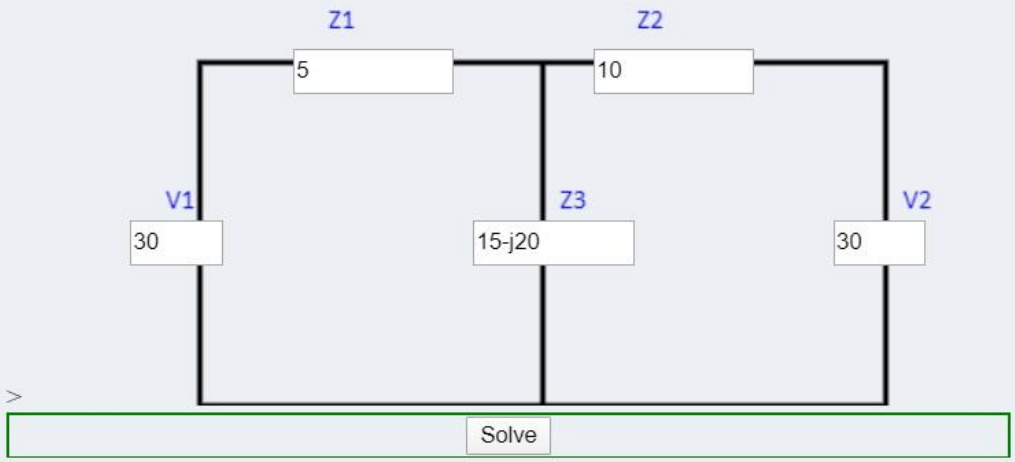
1.



When V1 Acting	
Req	16.8916+j3.5978
RT	26.8916+j3.5978
I1	0.3653+j0.0489
When V2 Acting	
Req'	9.2596+j1.0475
RT'	29.2596+j1.0475
I2	0.6827+j0.0244
IT	1.0480+j0.0733

2.

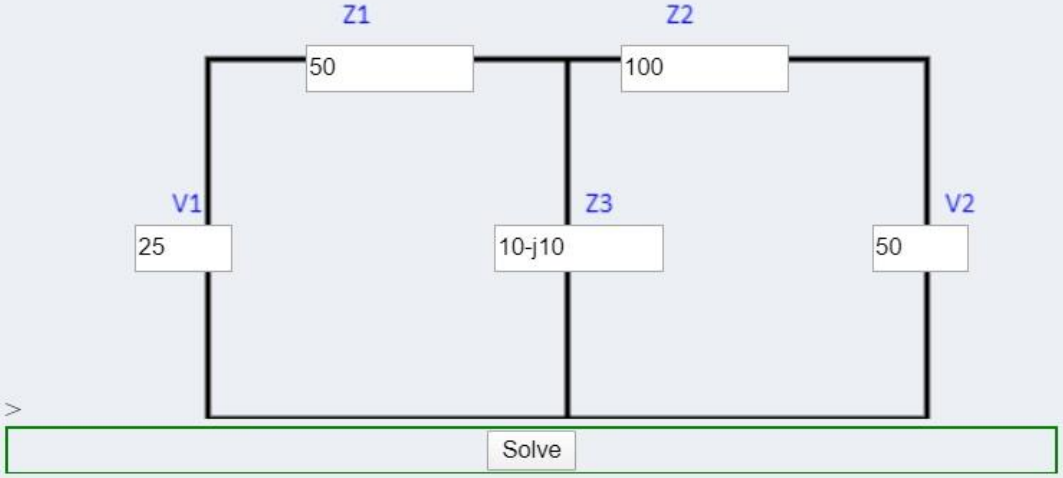
Simulation



When V1 Acting	
Req	7.5610+j1.9512
RT	12.5610+j1.9512
I1	2.3321+j0.3623
When V2 Acting	
Req'	4.3750+j0.6250
RT'	14.3750+j0.6250
I2	2.0830+j0.0906
IT	4.4151+j0.4528

3.

Simulation



When V1 Acting	
Req	9.8361+j8.1967
RT	59.8361+j8.1967
I1	0.4101+j0.0562
When V2 Acting	
Req'	9.4595+j6.7568
RT'	109.4595+j6.7568
I2	0.4551+j0.0281
IT	0.8652+j0.0843

RESULTS : The superposition theorem was verified.