

Series-Parallel ac Networks

16.1 INTRODUCTION

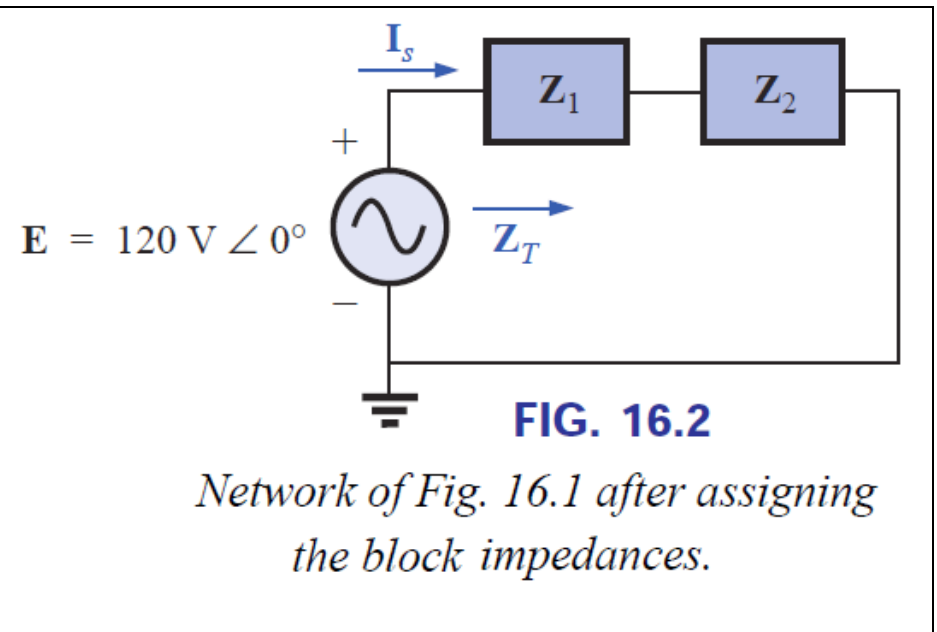
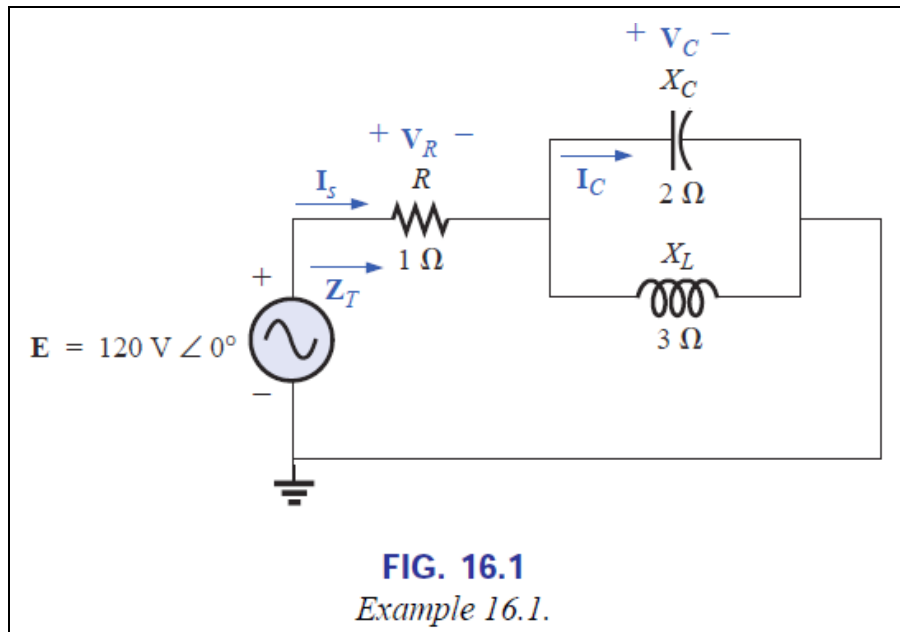
Solving **series-parallel ac networks** with a single source (potential or current) is very similar to the approach used for dc circuits.

- 1 - Study the problem in total and make a mental sketch of the approach you plan to use. (*block impedances*), (*reduce the network*).
- 2 - Examine each region independently \Rightarrow simplify the network
- 3 - Redraw the circuit as often as possible with the reduced branches and undisturbed unknown.
- 4 - When you have a solution, check that it is reasonable.

Rules for parallel current sources is the same as in the dc (using the phasors)

Rules for series voltage sources is the same as in the dc (using the phasors)

16.2 ILLUSTRATIVE EXAMPLES



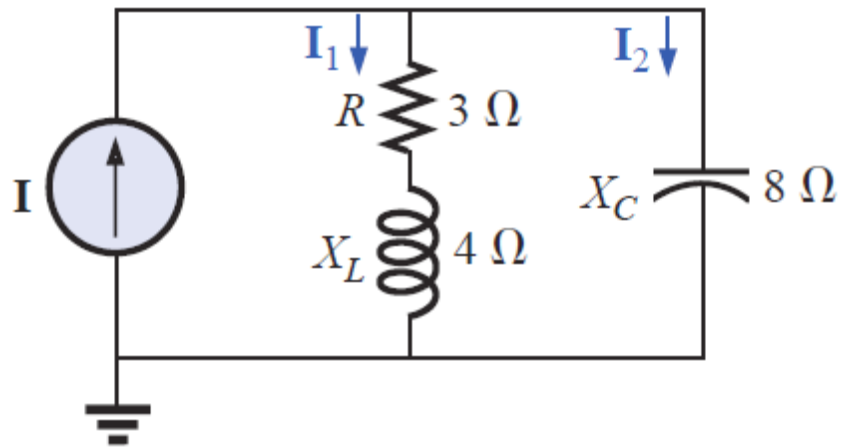


FIG. 16.3
Example 16.2.

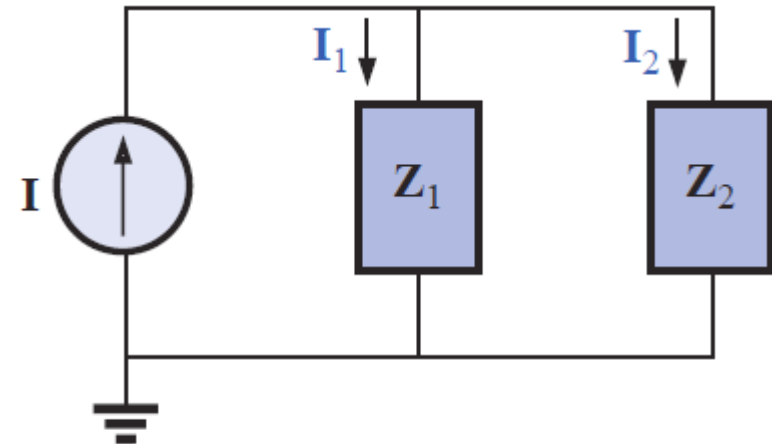


FIG. 16.4
Network of Fig. 16.3 after assigning the block impedances.

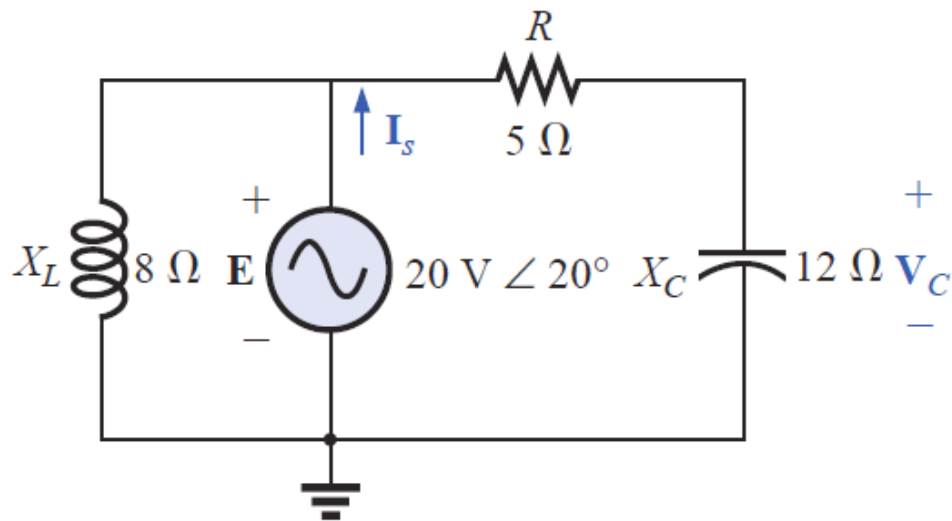


FIG. 16.5
Example 16.3.

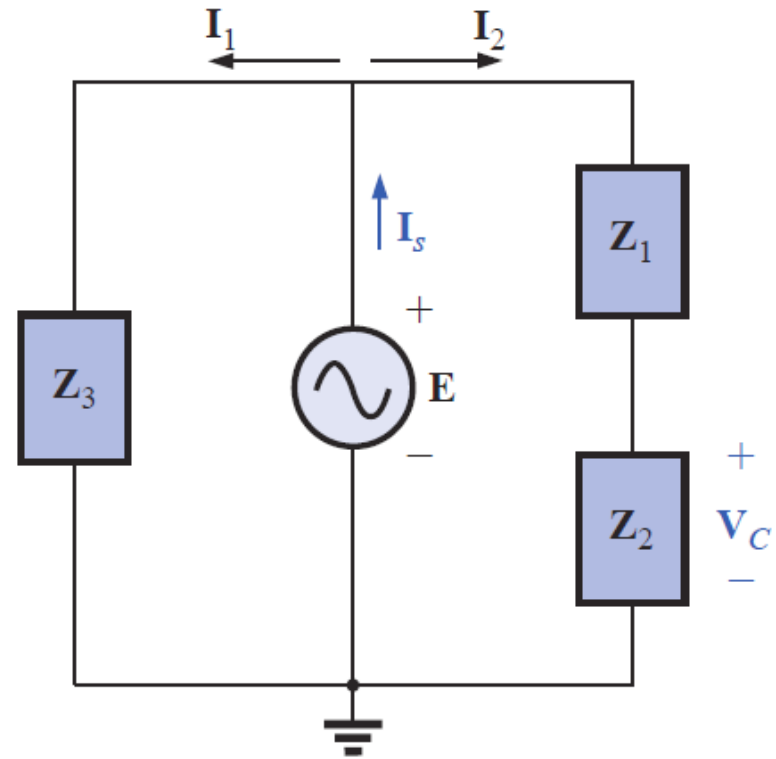


FIG. 16.6
*Network of Fig. 16.5 after assigning
the block impedances.*

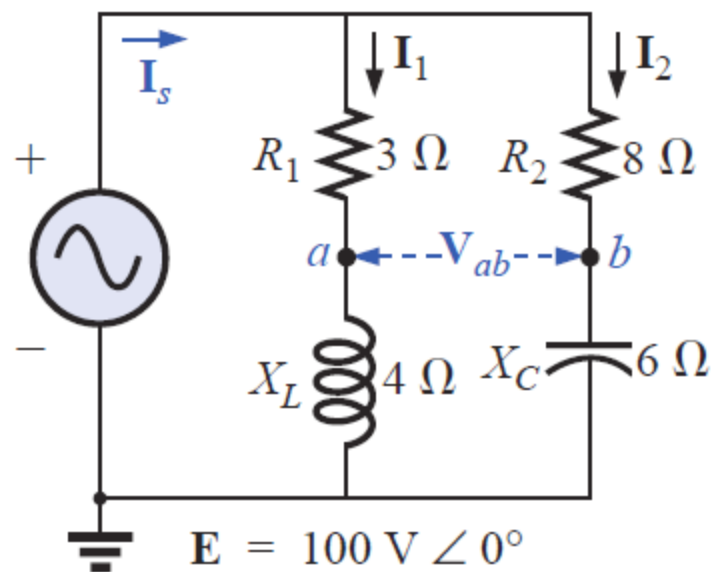


FIG. 16.7

Example 16.4.

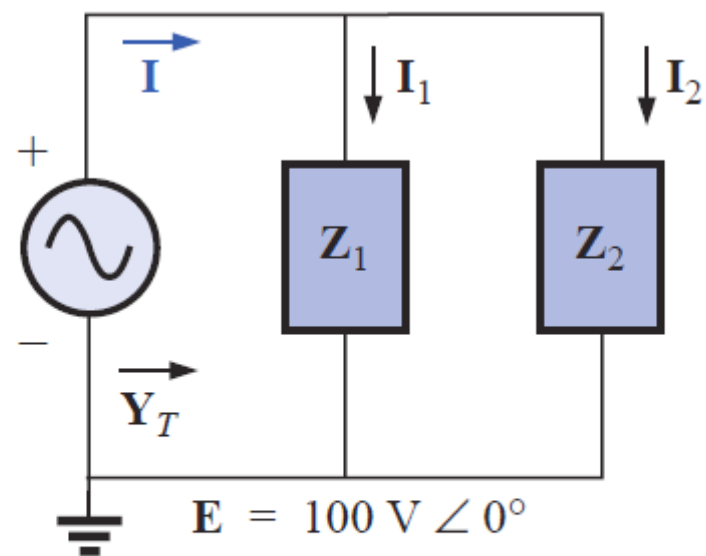
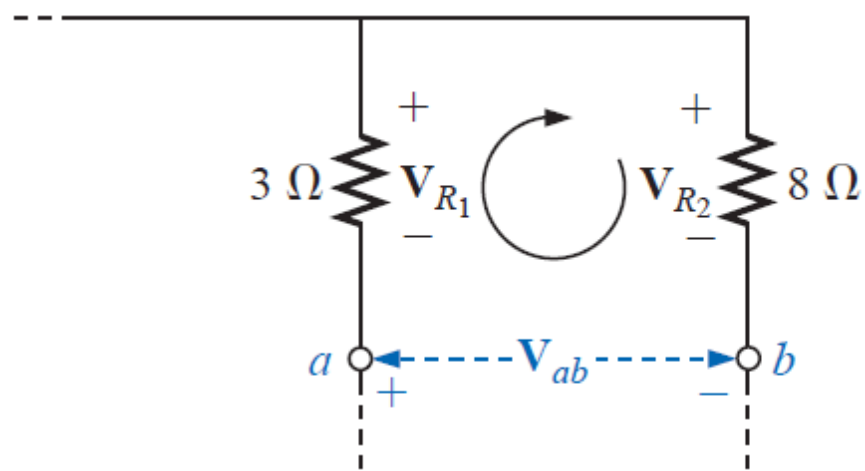
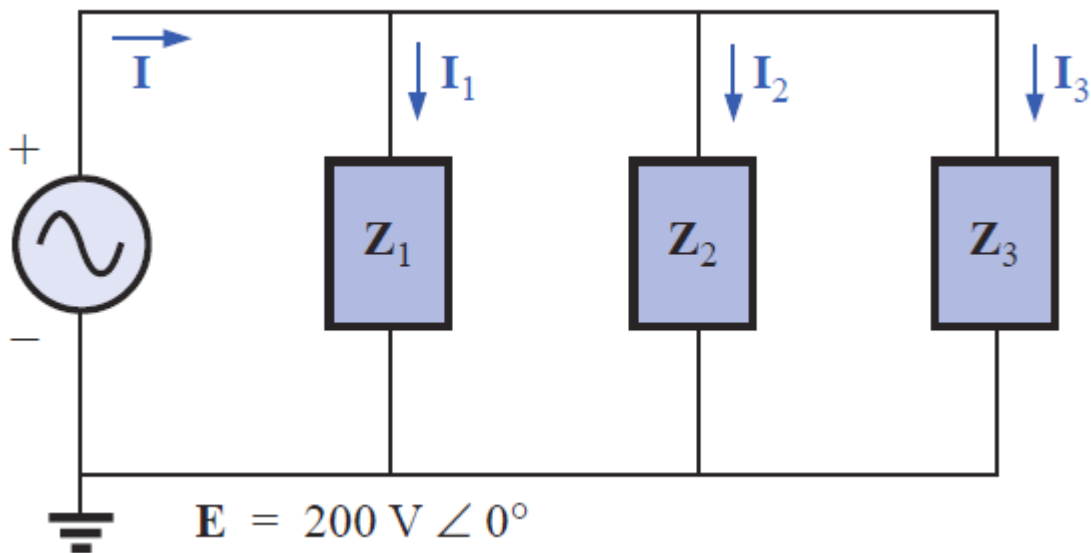
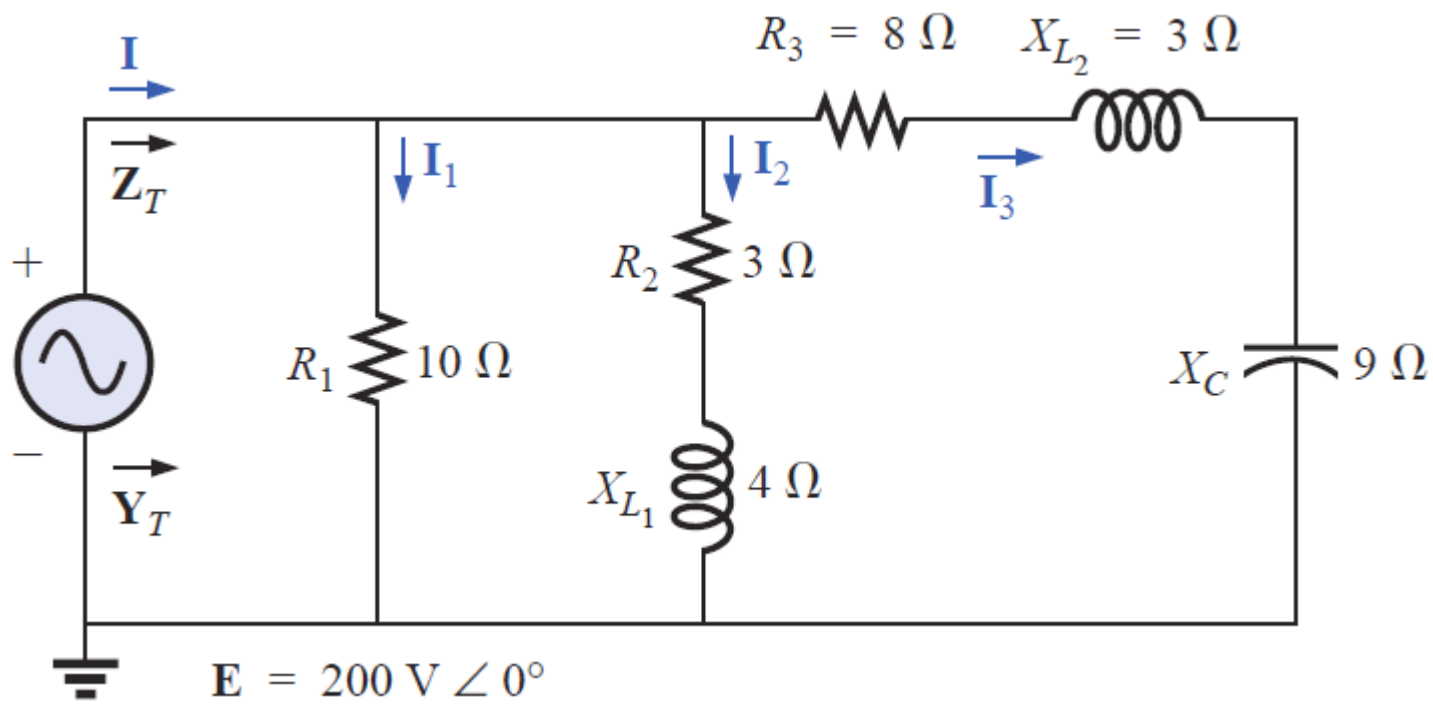
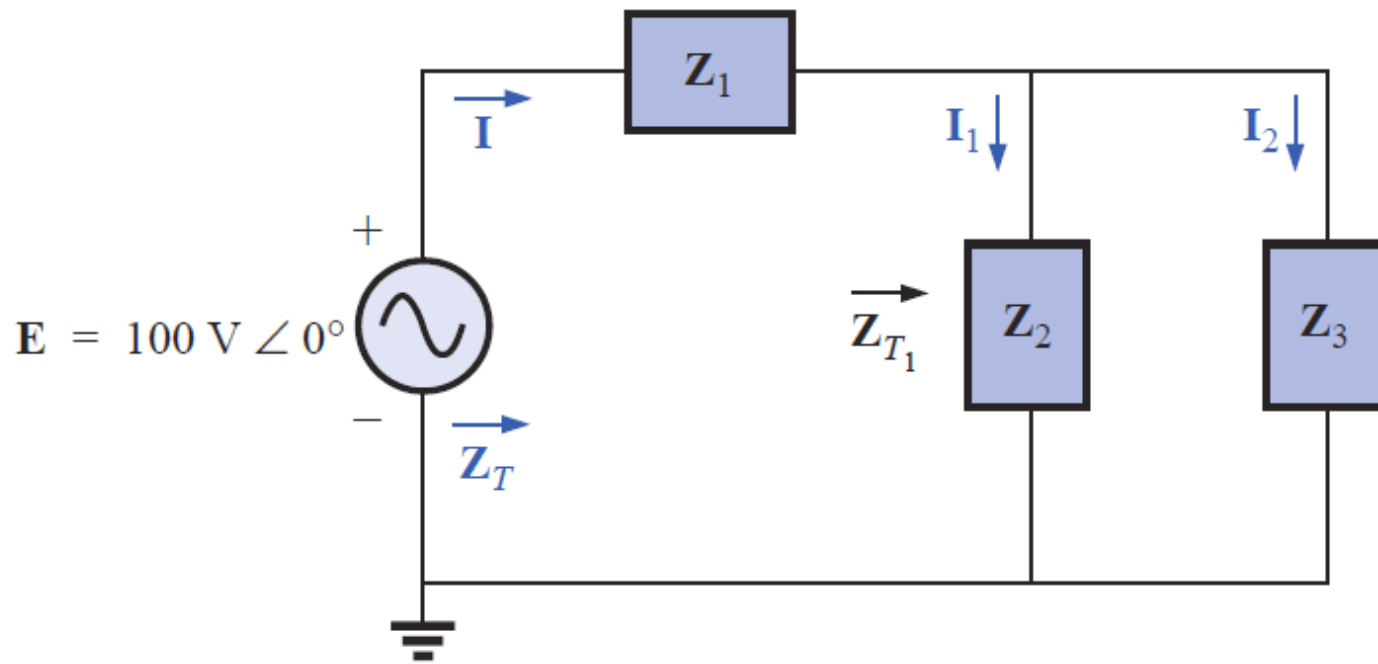
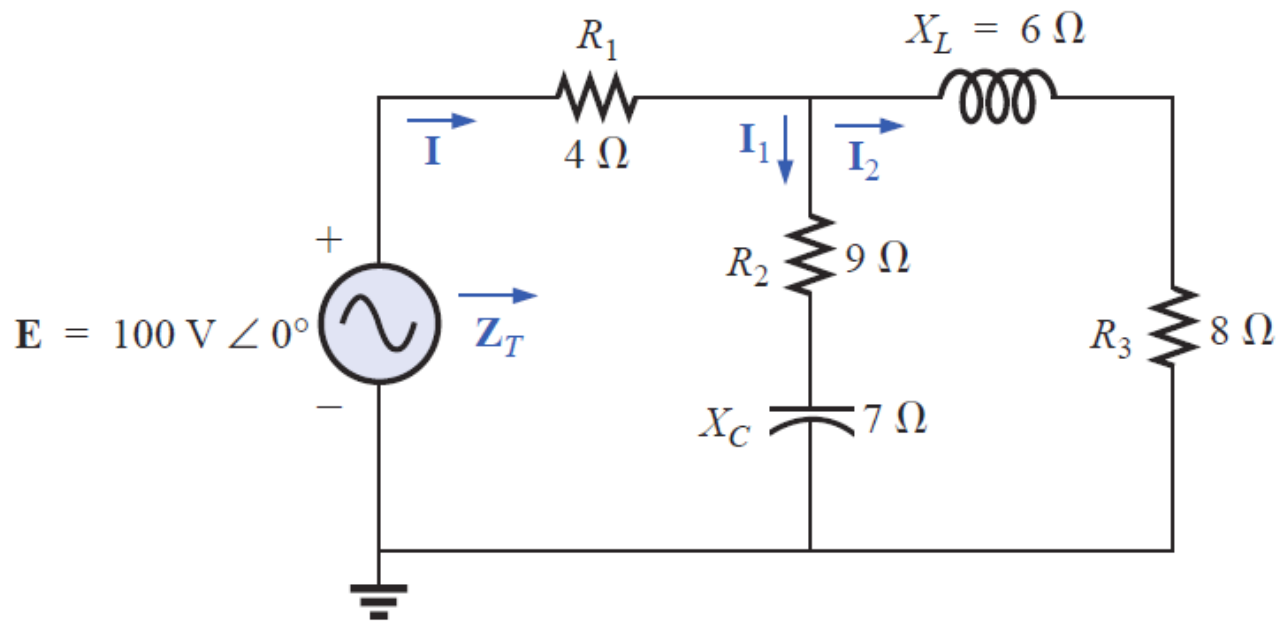


FIG. 16.8

Network of Fig. 16.7 after assigning the block impedances.







16.3 LADDER NETWORKS

The analysis of the Ladder Networks in ac circuits follows closely the method described for the dc circuit. Except E is a phasor, and the resistors are now impedances.

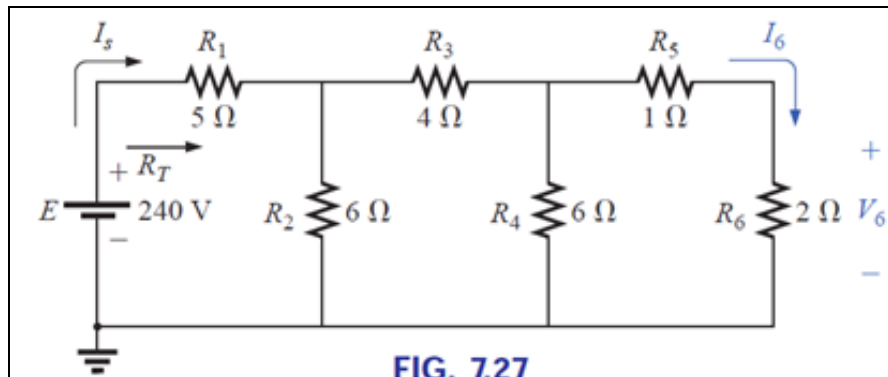


FIG. 7.27
Ladder network.

dc Ladder Network

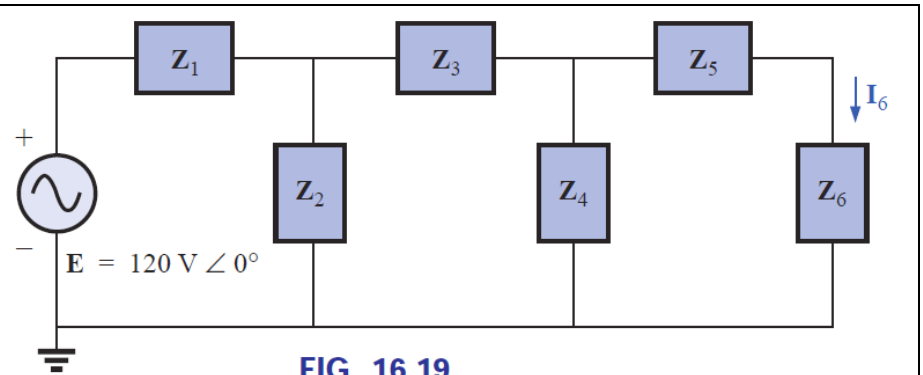


FIG. 16.19
Ladder network.

ac Ladder Network

$$\mathbf{Z}''_T = \mathbf{Z}_5 + \mathbf{Z}_6$$

$$\mathbf{Z}'_T = \mathbf{Z}_3 + \mathbf{Z}_4 \parallel \mathbf{Z}''_T$$

$$\mathbf{Z}_T = \mathbf{Z}_1 + \mathbf{Z}_2 \parallel \mathbf{Z}'_T$$

$$\mathbf{I} = \frac{\mathbf{E}}{\mathbf{Z}_T}$$

$$\mathbf{I}_3 = \frac{\mathbf{Z}_2 \mathbf{I}}{\mathbf{Z}_2 + \mathbf{Z}'_T}$$

$$\mathbf{I}_6 = \frac{\mathbf{Z}_4 \mathbf{I}_3}{\mathbf{Z}_4 + \mathbf{Z}''_T}$$

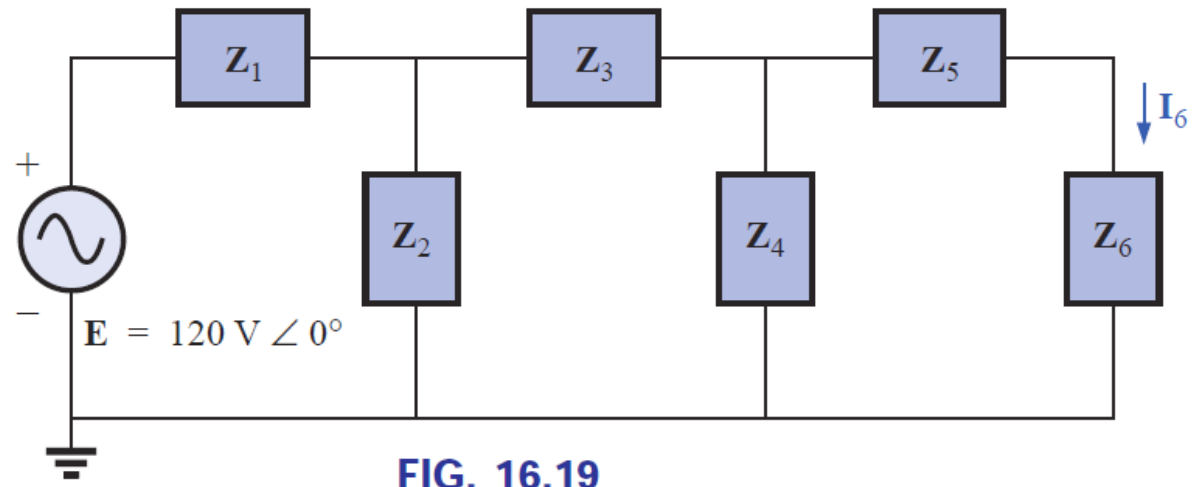


FIG. 16.19
Ladder network.

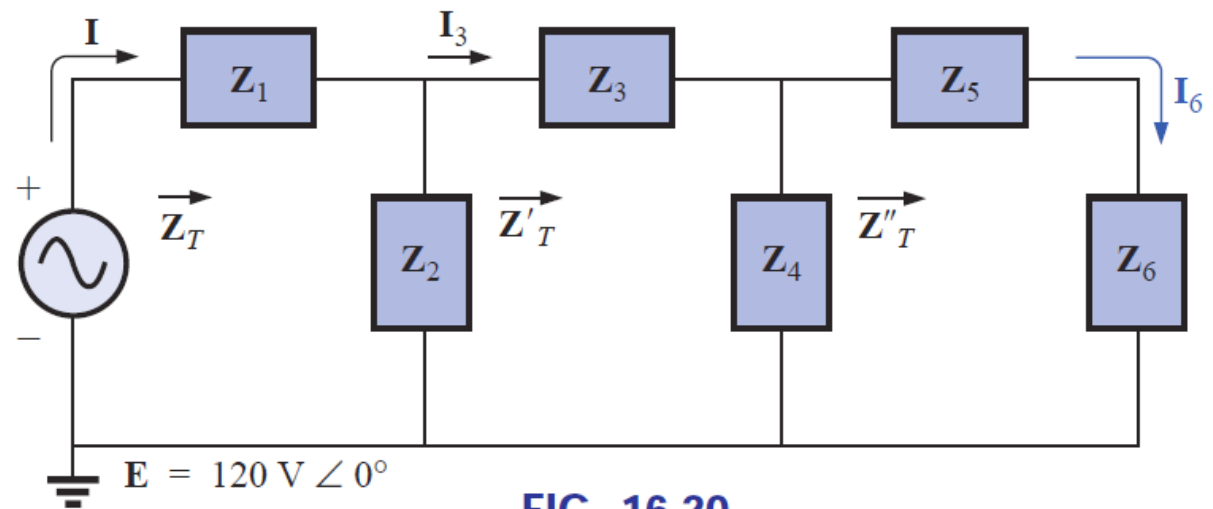


FIG. 16.20
Defining an approach to the analysis of ladder networks.