

**CHAPTER 5**

# **BEE3143:POWER SYSTEM ANALYSIS- Sequence Impedance Network**

**Expected Outcomes**

Able to solve unbalanced fault analysis

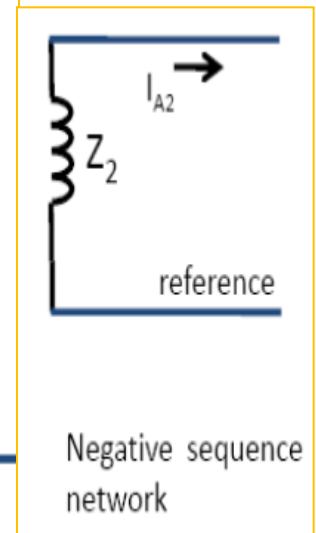
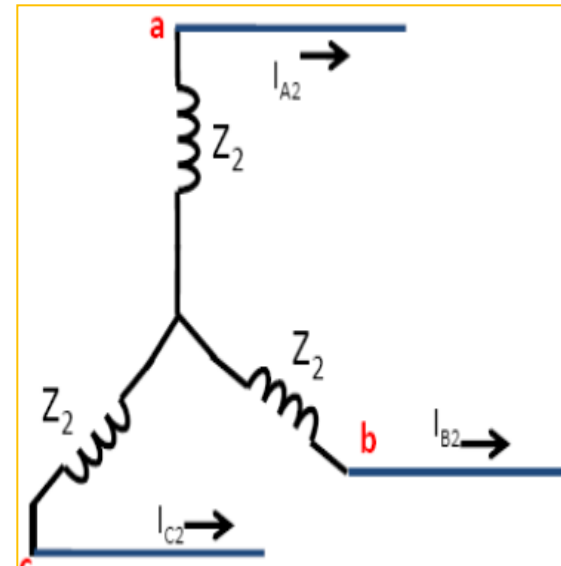
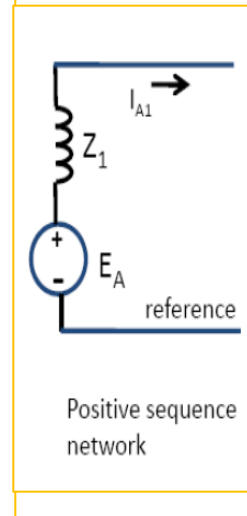
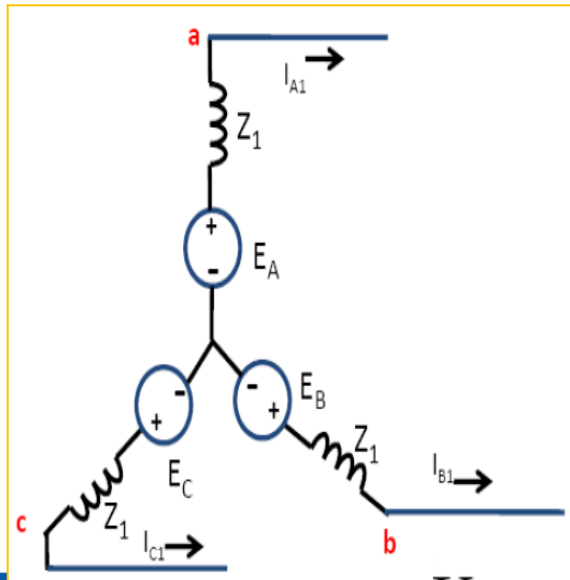
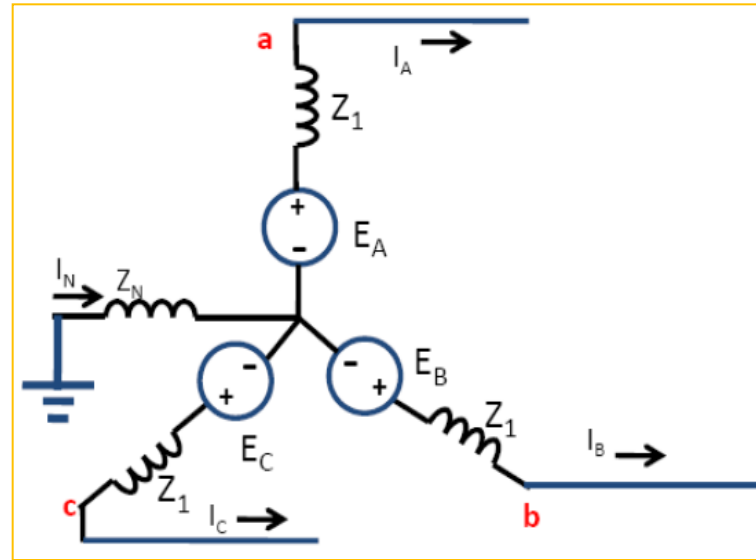
## Introduction

- The voltage drop caused by the currents of a particular sequence depends on the impedance of the circuit to currents of that sequence
- Impedance of a circuit can differ for positive sequence, negative sequence and zero sequence currents
  - Z positive sequence,  $Z_1$ :**  
Impedance of a circuit when only positive sequence current is flowing
  - Z negative sequence,  $Z_2$ :**  
Impedance of a circuit when only negative sequence current is flowing
  - Z zero sequence,  $Z_0$ :**  
Impedance of a circuit when only zero sequence current is flowing

# Sequence Impedance of Loaded Generator

- To analyzed an unsymmetrical fault, we must construct three different per-phase equivalent circuits
  - **positive-sequence network:** per-phase equivalent circuit containing only positive sequence impedance and sources
  - **negative sequence network:** per-phase equivalent circuit containing only negative sequence impedances
  - **zero-sequence network:** per-phase equivalent circuit containing only zero-sequence impedance

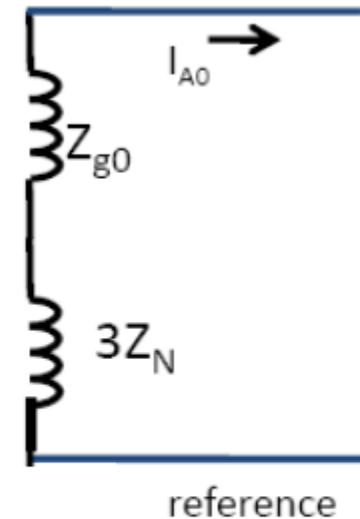
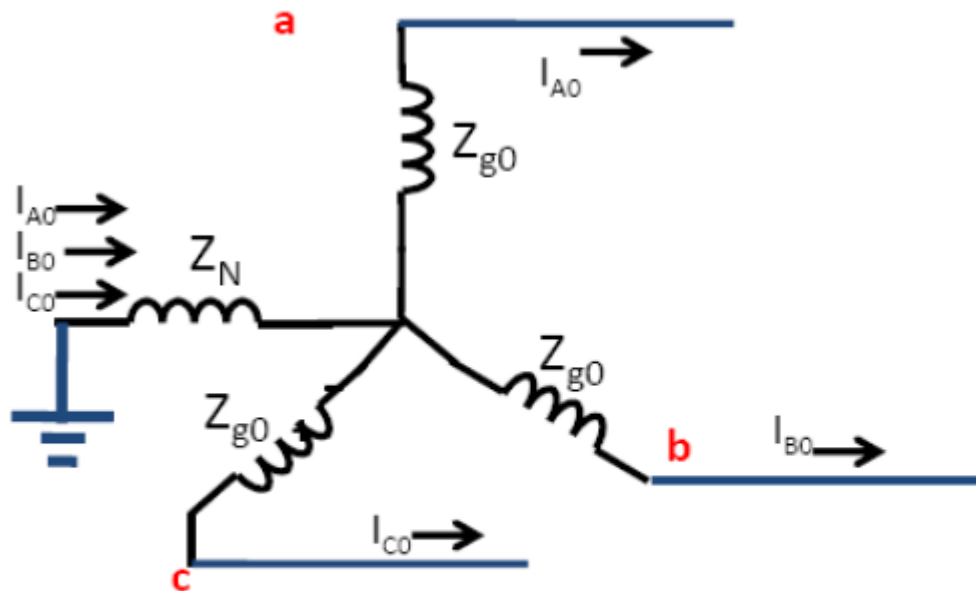
# ...Sequence Impedance of Loaded Generator



$$V_{A1} = E_A - I_{A1} Z_1$$

$$V_{A2} = -I_{A2} Z_2$$

# ...Sequence Impedance of Loaded Generator



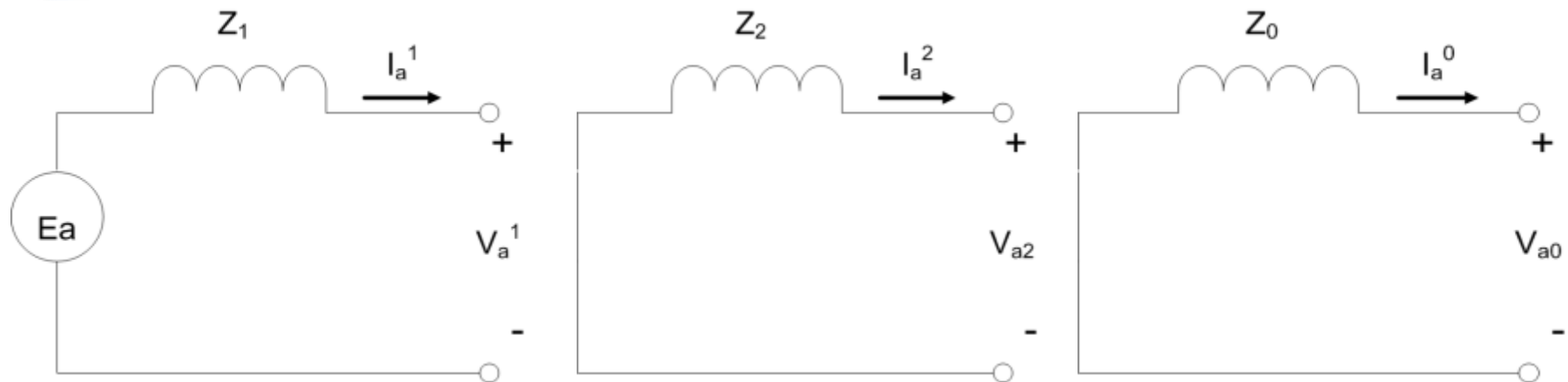
Zero sequence network

A synchronous generator as seen by zero-sequence currents

$$V_{A0} = -I_{A0}Z_0$$

# ...Sequence Impedance of Loaded Generator

Summary of sequence impedance network for positive, negative and zero sequence:



# Sequence Impedance of Transformer

- The positive and negative sequence of the  $3\phi$  transformer is balanced
- thus, the sequence equivalent circuit does not depend on the connection of the primary and secondary windings of the transformer
- The zero sequence impedance of the  $3\phi$  transformer is depends on the connection of the primary and secondary windings

# ...Sequence Impedance of Transformer

