Webinar on Introduction to Power System Studies Session 3: Earth Fault Analysis

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Organised by Electrical Engineering Technical Division

SPEAKER:

Ir. Lee Chong Kiow

Saturday, 8th August 2020

9.30AM – 11.30AM

FEE ANNOUNCEMENT
(Effective on 1st August 2020)

MEMBER : RM 15
NON - MEMBER : RM 50

Objectives:

1. **To reintroduce three old friends – the per unit system, Thevenin's theorem and symmetrical components or The Romance of the Three Sisters.**

2. **To breathe new life into old formulas and to transform old equations into meaningful entities, which can then be related to Ohm's law for a clearer understanding**

3. **To be able to make simple, quick and reasonably accurate estimates of the results of power system studies**

Session 4 on Load Flow & Motor Starting Analysis at 9.30 – 11.30 am on 22 August 2020

SYNOPSIS OF SESSION 3

Of the three types of shunt faults - three-phase, phase- and earth-faults - the most complicated is the earth fault due to the different methods of earthing the neutral.

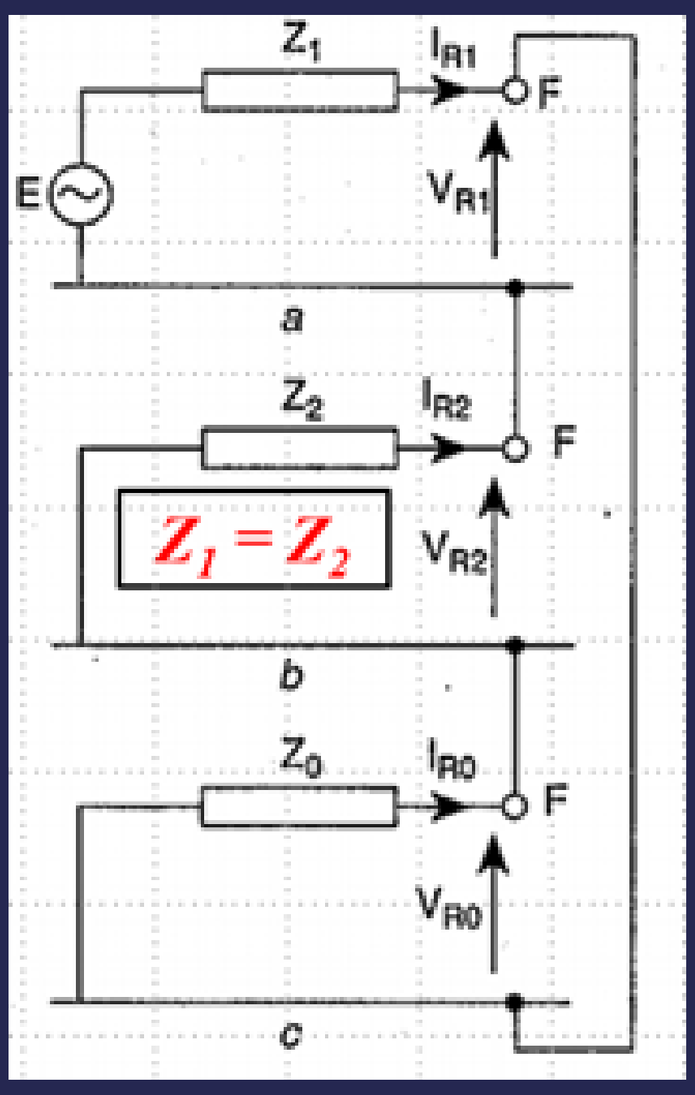
There are two approaches how to calculate the earth fault current:
The first is a relatively straightforward use of formulas to compute the single-phase fault current for the following cases:

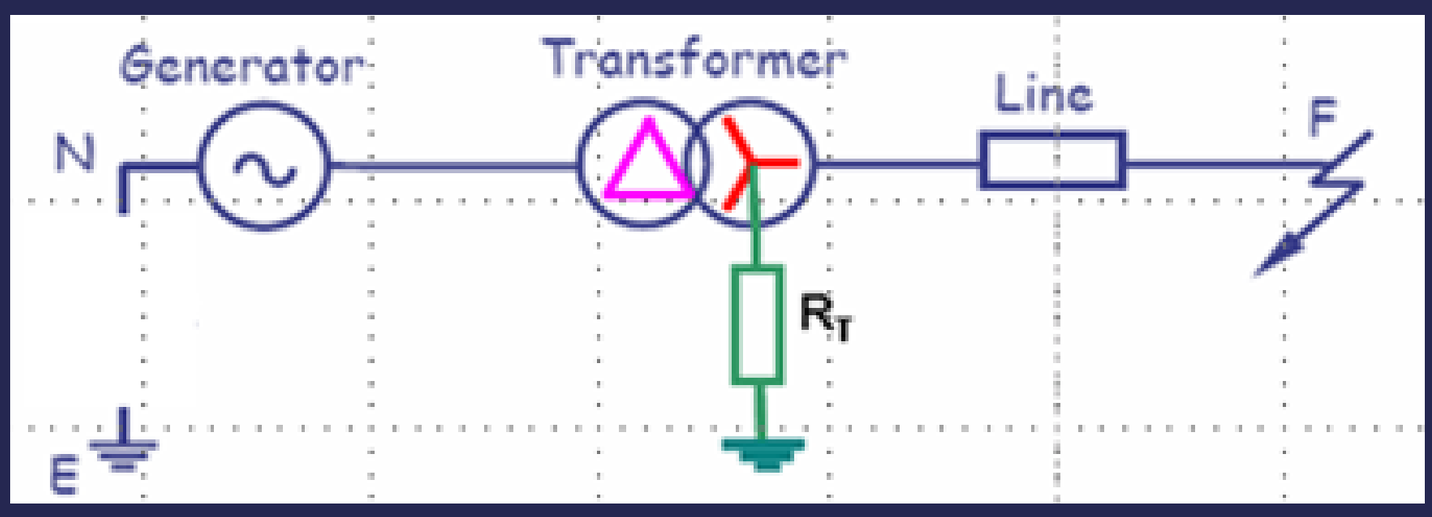
1. A solidly earthed Dyn transformer or generator
2. A Dyn transformer or generator earthed through a neutral earthing resistor
3. A YNd main transformer with a ZN neutral earthing transformer

The alternative in-depth approach is to consider the symmetrical components and the connection of the sequence networks for various types of faults. This is the icing on the cake that will enable the learner to understand the following:

1. Why the earth fault current, Ia = 3I0 ·
2. Why the equivalent earth fault impedance, Ze = ⅓ (2Z1Th + Z0Th)
3. Why the Thevenin zero sequence impedance excludes the zero sequence data upstream of a Dyn transformer
4. The flow of the sequence and phase currents in a system with a neutral earthing transformer

PRE- TALK EXERCISE





Draw the sequence network connection diagram for an earth fault at F in the above system, bearing in mind the following:

- *The generator neutral is not earthed*
- *The total equivalent earth fault impedance,*
  $Z_e = ⅓ (2Z_{1Th} + Z_{0Th})$

Z_{1Th} = Total upstream positive sequence impedance

Z_{0Th} = Zero sequence impedance of the last upstream Dyn transformer

A good understanding of the above process is vital to an appreciation of the beauty of symmetrical components

Ir. Lee Chong Kiow is a 1974 electrical engineering graduate from Strathclyde University, Glasgow, with 50 years of experience in the power supply industry. He specialises in providing technical training of electrical courses and performing power system studies. His previous experience included working as the Engineering Manager in a company manufacturing indoor medium- and low-voltage switchgear, Associate Director in a large consultancy practice and protection engineer with the former National Electricity Board. He is an Energy Commission certified competent/services engineer up to 275kV.
He has trained about 7,000 participants from electrical utilities, petrochemical industry and multi-national companies in several countries in Asia and Africa on a variety of topics related to electrical engineering.