

# INTRODUCTION TO POWER SYSTEM STUDIES SESSION 1

Saturday | 13 June 2020 | 2.00PM – 4.00PM

Free admission for members | Register online

## SYNOPSIS

### The Three Pillars

Electrical engineers must have a good grasp of the three pillars of power system studies – the per unit system, Thevenin's theorem and symmetrical components.

### The $N^2$ Effect of Transformers

A transformer has the effect of changing the impedance of a component during the transformation of voltage and current, i.e. a 33 kV 9-ohm cable and an 11 kV 1-ohm cable for a 33/11 kV transformer will have the same effect in terms of losses and percentage or per unit voltage. It is then necessary to apply a  $N^2$  factor before any addition of such impedances, where  $N$  is the transformer ratio. In other words, the equivalent primary impedance,  $Z_p = N^2 Z_s$ , where  $Z_s$  is the secondary impedance.

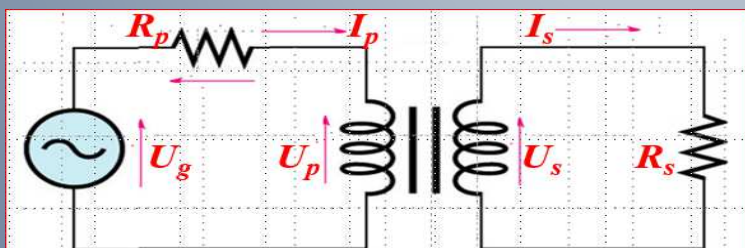
### The Per Unit System

The per unit system requires two sets of formulas. The first set will be used to calculate the per unit bases. The second set is to convert the rated data for the various components into per unit impedances. Because of its inherent  $N^2$  factor, the per unit system permits the addition of per unit impedances, i.e. it has effectively reduced all transformers, which complicates the various calculations, to 1/1 per unit ratio.

## SPEAKER

**Ir. Lee Chong Kiow** is a 1974 electrical engineering graduate from Strathclyde University, Glasgow with more than 50 years of experience in the power supply industry. He specialises in providing technical training of electrical courses and performing power system studies. Previously he worked as the Engineering Manager of Tamco Corporate Holdings Sdn Bhd, which manufactures indoor medium- and low-voltage switchgear. Ir. Lee has more than 15 years working as a protection engineer in a Lembaga Letrik Negara and another five years in a large consultancy practice. On top of that, he is also a Suruhanjaya Tenaga certified competent/services engineer up to 275kV. Since 1997, trained about 7,000 participants from electricity utilities, petrochemical industry and multi-national companies throughout Malaysia as well several countries in Asia & Africa on a variety of topics.

### Pre-Talk Exercise



Webinar Session 2 on Thevenin's Theorem and Three-Phase Fault Analysis will be held on **18 July 2020** 9.30 am – 11.30 am

Calculate  $I_s$  for an 80/40 V ideal single-phase transformer with an ideal 80 V source with  $R_p = 8 \Omega$  and  $R_s = 8 \Omega$