Talk On "A Simplified Equation for Voltage Drop" (OR IS VOLTAGE DROP = IZ?)

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A voltmeter measures the voltage across the impedance in terms of the vector difference between the two points. However, voltage drop is the scalar difference between two voltages. This simply means that a voltmeter is not to be used to measure the voltage drop along a cable or a transmission system. Besides the magnitudes of the current, I and impedance Z, the angle of load and angle of impedance must also be considered in determining the voltage drop. In other words, voltage drop only equals to the product of current and impedance, IZ under certain condition.

Voltage drop is a steady state change of voltage during normal load flow and biggest voltage drops tend to happen at the generators and transformers. The voltage drop formula is mainly applied in load flow analysis and motor starting. In the latter case, the term voltage dip is usually used to describe it. The biggest starting impedance tends to be at the motor loads. Cables within a plant have relatively lower impedances and hence lower voltage drops.

Figure 1 : Ir. Lee (left) receiving a token of appreciation from the Chairman of EETD, Ir. Yau (right)

In a typical power system, the generator is the most complicated electrical equipment as it has several impedances to cater for the changes in its behavior with time during short-circuits and motor starting. Due to its resistance which is relatively small to minimize losses, its impedance is defined by reactance, X and not Z. The change of X can be divided into 3 regions namely sub transient, transient and synchronous.

Figure 2: Participants at the talk

There are 16 different reactance values which can be extracted from the generator datasheet provided by the manufacturer. For short circuit studies, the reactance value for saturated condition should be considered. On the other hand, for load flow or motor starting, the reactance value for unsaturated condition should be considered.