Fuzzy Estimation for Fault Location

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Abstract

This paper presented Fuzzy logic application to Electrical power system analysis for fault location estimation in distribution lines and apply the Power system theory to be fuzzy logic database The case study referred to the Overhead distribution line of the Provincial Electricity Authority (PEA.), Thailand which mostly the distribution line of PEA. are Radial schemes.These benefits include reduced outage time, help in locating momentary faults, enhance safety to the line crews and provide notification of an outage without receiving calls from the consumer,Which these benefits also increase Reliability, Stability and Efficiency.

1. Introduction

The distribution line of PEA. has supplied the voltage level at 22 and 33 kV. to consumer and the distribution line is Open Loop Schemes for increase Reliability and Stability of system. Which each feeders are Radial Schemes and installed Load Break Switch at tie line as shown in Fig. 1. [4].

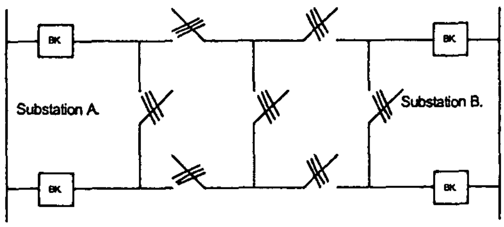

Fig. 1. The Open-Loop Schemes.

The fault location Estimation is serious problem for distribution system. Because of the Power system theory not able to solve this problem perfectly. In practical when a fault occurred, the Fault impedance is depending on weather, surrounding and ground properties. So very difficult to define Z_f correctly to be the parameter for Fault current calculation by the power system theory. Therefore the fuzzy logic theory to help for the estimation fault distance is easily than the power system calculating.

2. Fault Location Determination

The fault location design can be divided into two parts such as the following [2]:

2.1Fault Calculation

For this papers referred the single line diagram of Phakthongchai Substation is in Fig.2. on a base of 25 MVA, 22kV [5].

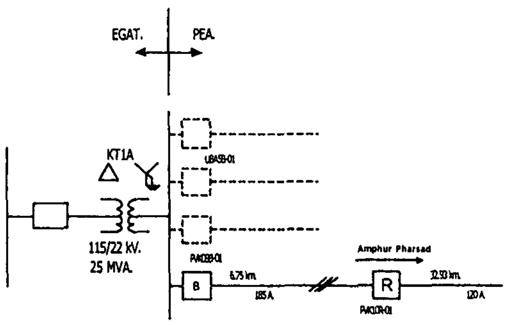

Fig. 2. The Single line Diagram of Phakthongchai Substation.

$$I_{base} = \frac{kVA_{base}}{\sqrt{3}kV_{base}} = \frac{25000}{\sqrt{3}\times 22} = 656 \quad A \qquad (1)$$

$$Z_{base} = \frac{(KVA_{base})^2}{MVA_{base}} = \frac{(22)^2}{25} = 19.36 \quad \Omega \qquad (2)$$

The fault current at busbar was informed by Electricity Generating Authority of Thailand (EGAT.) and able to fine impedance. (Z_1 = Positive Sequence, Z_2 = Negative Sequence and Z_3 = Zero Sequence) of system from Power Plant to 22 kV. busbar of PEA. are

At Busbar:

$$I_{3\phi} = 5255 \quad A$$

$$I_{\phi-g} = 7175 \quad A$$

$$I_{3\phi} = \frac{V_{pu}}{Z_{1\,pu}} \times I_{base} \quad A \qquad (3)$$

$$Z_{1\,pu} = \frac{V_{pu} \times I_{base}}{I_{3\phi}} \quad pu \qquad (4)$$

$$= \frac{1 \times 656}{5255} = j0.12821 \quad pu$$

$$I_{\phi-g} = \frac{3V_{pu} \times I_{base}}{(Z_1 + Z_2 + Z_3)_{pu}} \quad A \qquad (5)$$

$$(Z_1 + Z_2 + Z_3)_{pu} = \frac{3\times V_{pu} \times I_{base}}{I_{\phi-g}} \quad A \qquad (6)$$

$$= \frac{3\times 1\times 656}{7175} = j0.274280 \quad pu$$