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PII: S0263-2241(17)30136-7
DOI: http://dx.doi.org/10.1016/j.measurement.2017.02.041
Reference: MEASUR 4626

To appear in: *Measurement*

Received Date: 14 October 2016
Revised Date: 30 January 2017
Accepted Date: 21 February 2017

# A Novel Single End Measuring System Based Fast Identification Scheme for Transmission Line Faults

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*Abstract*–This paper proposes a novel single end measuring system for fast fault identification in transmission lines (TL). The proposed scheme combines the merits of Discrete Wavelet Transform (DWT) and Karen Bell Transformation (KBT) for the fault analysis process. The proposed scheme is independent on threshold value. The proposed algorithm tested on a 350 km, 500 kV transmission line for different fault types using ATP/EMTP simulation package. Critical issues like a variation in fault location, fault resistance, fault inception angle and different source capacities are validated using the proposed scheme. The scheme extracts distinctive fault features over 1/16 of a cycle data windows with sampling frequency 6.4 kHz. The proposed scheme detects and classifies the fault using only 8 samples from power cycle and the average of fault detection time is 1.25 ms. The obtained results indicate that the developed scheme is fast, reliable, robust compared to the previous works in the literature.

*Key words:* Power transmission lines, discrete wavelet transform, Karen-Bell transformation, fast fault identification.

## I. Introduction

Fast and accurate identification of faults in transmission lines is an urgent challenge to rehabilitation of the faulted area and to retrieve the power in electrical power systems. The fault type classification is an important aspect of the identification process. The correct classification of the fault type has significant effects on relaying scheme. Therefore, the accurate fault detection algorithms for different fault conditions are very significant area of research [1].

References [2]-[4] introduced a review study about fault identification schemes for transmission networks. The authors in [2] proposed sensitive and automated fault identification scheme and mainly concentrate with accurate fault detection without concentrating on the speed of fault detection. One of the important merits of wavelet transform schemes is the fast fault detection response [3] and [4].For most fault identification schemes in the literature, the most important issue is the way that employed to extract the high frequency component from the faulted signal [5], [6]. References [7] and [8] detect the faults in TL using WT and discrete Fourier transform (DFT) methods. In Ref. [9], a fault detection method was proposed by using RMS values of the instantaneous powers from both sides of the TL. This scheme takes long than one cycle to determine RMS value. In [10], another approach was presented on the basis of the principles of parameter estimation. In [11], a method was proposed to characterize the power system changes using RMS voltage. Reference [12] proposed a fault identification scheme that employed the frequency analysis of current and voltage angles using DFT. Reference [13] presented a protection algorithm for TL based on synchronized phasor measurements. It was found that the mean fault detection time is 1.62 ms.

References [14]–[16] developed the fault classification using artificial neural network (ANN) in TL. In [14], the fault classification average time is 5-7 ms. While, the average fault classification time is 4-5ms [15].Reference [16] proposed a scheme that dependent on the multi-resolution S-transform and probabilistic neural network. The support vector machine (SVM) was