

Signal Processing Technique Based Transmission Line Protection With and Without Penetration of Wind Energy

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Abstract:

The rapid progression in the field of technology in recent decades resulted in the emergence of renewable energy resources in the power system. This penetration of renewable sources in power grids gives rise to problems like variable and hardly predictable generation capacity. Thus, an effective and reliable protection scheme is essential for this technological advancement. This paper introduces a hybrid combination-based algorithm of three different signal processing techniques - Hilbert Transform (HT), Stockwell Transform (ST), Alienation Coefficient (ACF). Current signals are decomposed by using HT, ST, and ACF for concluding H-factor, S-factor, A-factor respectively. Further, these factors are multiplied by the element-by-element method for the calculation of the Proposed fault factor (PFF). In addition, the ground's role in the case with two-phase faults must be determined. The S-factor is used to calculate the proposed ground fault factor (PGFF). The study is being done for double line fault (LLF), double line to ground fault (LLGF), triple line fault (LLLGF), and triple line to ground fault (LLLGF). The experiment is carried out in a MATLAB/Simulink environment on a two-terminal transmission line with and without penetration of wind energy.

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I. Introduction

Several techniques using wavelet transform, neural net-works, and ACF are reported in [1], [2] for identifying and locating faults on transmission lines compensated by the Unified Power Flow Controller (UPFC). A technique based on ST and WDF that provides effective protection to a power transmission line under varied operating conditions, including variations in AFI, fault impedance, and loading conditions is described in [3]. The algorithm effectively distinguishes between switching and faulty events. On the transmission line, faulty occurrences such as a single line to ground fault (LGF), LLF, LLGF, LLLGF create tensile stresses, high component heating, and imbalance current in the utility system. As a result, as soon as a fault is detected, the transmission line should be tripped. The Advantages of S Transform over continuous wavelet transform are reported in [4]. Based on a detailed examination of the literature reviews discussed in this paper, it has been determined that hybridizing two or more signal processing techniques can significantly boost the effectiveness of protection schemes.

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