

## A COMPUTATIONALLY EFFICIENT ALGORITHM FOR ACCURATE PHASOR ESTIMATION IN THE PRESENCE OF DECAYING DC COMPONENT IN FAULT CURRENT SIGNALS

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### ABSTRACT

This paper presents a novel and computationally efficient algorithm for improving the accuracy of phasor estimation in the presence of a decaying DC (DDC) component in fault current signals of transmission lines. In digital protective relays, the Discrete Fourier Transform (DFT) is widely employed for estimating the fundamental frequency phasor. However, the presence of a DDC component—typically introduced due to asymmetrical fault conditions and system inductance—can significantly degrade estimation accuracy, leading to errors in both magnitude and phase. The proposed algorithm mitigates the adverse effects of the DDC component by introducing a two-step correction procedure. In the first step, the fault current samples are cumulatively summed over a one-period data window, which is then shifted sample-by-sample across the signal to generate a sequence of aggregated values. In the second step, a logarithmic transformation is applied to these values to estimate the parameters of the DDC component analytically. The method requires only  $N+4$  samples, where  $N$  corresponds to one fundamental period, making it suitable for real-time implementation in protective relays with limited computational resources. Unlike conventional filtering or compensation techniques, the proposed approach enables direct analytical extraction of DDC parameters without iterative procedures. The algorithm has been validated using computer-generated fault signals, demonstrating strong robustness against measurement noise and higher-order harmonics. These characteristics make the method particularly attractive for high-speed and reliable protection schemes in modern power systems.

**Keywords:** Phasor estimation, fault current, Discrete Fourier Transform (DFT), decaying DC component (DDC), logarithmic transformation, protective relays.