An improved adaptive filtering approach for power quality analysis of time-varying waveforms

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PII: S0263-2241(18)30818-2
DOI: https://doi.org/10.1016/j.measurement.2018.08.073
Reference: MEASUR 5852

To appear in: *Measurement*

Received Date: 5 April 2016
Accepted Date: 31 August 2018

Please cite this article as: K. Thirumala, A.C. Umarikar, T. Jain, An improved adaptive filtering approach for power quality analysis of time-varying waveforms, *Measurement* (2018), doi: https://doi.org/10.1016/j.measurement.2018.08.073

An improved adaptive filtering approach for power quality analysis of time-varying waveforms

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Abstract

An improved adaptive technique is proposed to estimate the frequencies, thereby decomposing the nonstationary signal for the analysis of time-varying disturbances. The proposed method is based on the successive application of FFT and followed by the adaptive filter design. The FFT based frequency estimation has been performed based on divide to conquer principle for accurate estimation of harmonics and inter-harmonics. The estimated frequencies are processed and the empirical wavelet filters are designed accordingly for extracting the mono-frequency components. Thereafter, the instantaneous frequency and amplitude of each component have been estimated by applying Hilbert transform. The effectiveness of the proposed method has been verified by testing it on various simulated as well as measured power quality signals containing harmonics, inter-harmonics, fundamental frequency deviation, transients, sag and swell. The results confirm that the proposed method is able to analyse the time-varying power quality signals accurately and rapidly, making it suitable for real-time monitoring.

Keywords: Empirical wavelet transform (EWT), fast Fourier transform (FFT), Hilbert transform (HT), power quality (PQ)

1. Introduction

Rapidly growing use of harmonic-generating equipments and integration of renewable energy conversion systems led to an increasing interest in the analysis of power quality (PQ) signals [1, 2]. Further, there are many sources of the PQ disturbances that directly affect the system performance, transmission system equipment and degrades lifetime of end-user equipments, which are most sensitive. The survey on existing industry practices of PQ

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