Limits and Usability of Fast Fourier, Discrete Waveletand Wavelet Packet Transforms Applied at Signalsfrom a Primary Winding of a Locomotive Transformer

Ileana-Diana Nicolae
Dept. of Computer Science and Information Technology
University of Craiova, Romania
Craiova, Romania
nicolae_ileana@software.ucv.ro
Radu-Florin Marinescu, Petre-Marian Nicolae and
Maria Diana Cristina
Dept. of Electrical Engineering, Aeronautics and Energetics
University of Craiova, Romania
Craiova, Romania
marinescu_radu_florin@yahoo.com, pnicolae@elth.ucv.ro,
and maria.diana_cristina@yahoo.com

***Abstract*—Single phase currents and voltages were acquired from the primary winding of a locomotive transformer. Four operating regimes were considered (acceleration, running at constant speed, normal and respectively regenerative braking). 6 data sets consisting of 3 consecutive periods were considered as representative for this study and analyzed: one per each of the first 3 mentioned operating regimes and 3 for the regenerative braking. Fast Fourier Transform) and Wavelet Packet Transform were used to evaluate the harmonic spectra, Discrete Wavelet Transform was used to plot the instantaneous variations over frequency ranges of the distortions and all methods were used to evaluate the 3 major root mean square values (for fundamental frequency, for distorting residue and total). Total harmonic distortions were also evaluated. The results yielded by different methods were compared. A good convergence of methods was noticed. Explanations for the small differences are proposed.**

***Keywords*— power engineering computing; power quality; Wavelet transforms; Fast Fourier Transform.**

REFERENCES

[1] I.D. Nicolae and P.M. Nicolae, "Performances Evaluation of a Class of Original Discrete Wavelet Transform Based Hybrid Algorithms", Proceedings of IEEE conf. ICHQP 2012, Hong-Kong, pp. 727 – 732.
[2] I.D. Nicolae , P.M.Nicolae, M.Ş. Nicolae and A. Chiva, "Improving Efficiency of DWT Analysis through Faster Interpolation Methods and Multithreading Techniques", Annals of the University of Craiova, Electrical Engineering series, No. 38, 2014, pp. 44-49.
[3] W.G. Morsi and M.E. El-Hawary, "Reformulating Power Compo-nents Definitions Contained in the IEEE Standard 1459-2000 Using Discrete Wavelet Transform", IEEE Trans. on Power Deliv-ery, vol. 22, no. 3, pp.1910-1916, July 2007.
[4] Nicolae, I.D. and Nicolae, P.M., " Practical Aspects Related to Paired Nodes and Paired Harmonics in WPT Analysis", Proceedings of IEEE conf. IECON 2016, Florence, pp. 1-6.
[5] J. Barros and R. Diego, "Analysis of harmonics in power systems using wavelet packet transform". IEEE Trans. Instrumentation and Measurement, vol. 57, pp. 63-69, Jan. 2008.
[6] E.Hamid and Z. Yokoyama Kawasaki , „Rms and Power Measurements: A Wavelet Packet Transform Approach". Trans. Institute of Electrical Engineers of Japan, vol. 122-B , no. 5, pp.599-606, May, 2002.
[7] J. Barros, R. Diego and M. Apraiz, "Applications of wavelet transform for analysis of harmonic distortion in power systems: A review. ", IEEE Trans. on Instr. and Measurement, 61 (10), pp. 2604 – 2611, Sept. 2012.
[8] A. Tugulea, "Criteria for the Definitions of the Electric Power Quality and its Measurement Systems," *ETEP*, vol. 6, no.5, pp.357-363, 1996.
[9] I.D. Nicolae, P.M. Nicolae, D.C. Maria, L. Scărlătescu, Evaluating RMS of Linearly Variable Magnitude Waveforms by Using FFT and WPT. Theory and Practice., Annals of the University of Craiova, Electrical Engineering series, No. 40, 2016, pp. 33-38
[10] K. Cartwright, „Determining the effective or RMS voltage of various waveforms without calculus", Technology Interface/Fall 2007, pag. 1-20, available at http://tiij.org/issues/issues/fall2007/
30_Cartwright/Cartwright-Waveforms.pdf , 2007, retrieved 2017.