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CRITERIA FOR THE NECESSARY AND SUFFICIENT NUMBER OF ITERATIONS OF FILTERING NON-PERIODIC NON-STATIONARY SIGNALS BY MULTI-ITERATIVE METHODS

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Abstract

An analysis of efficiency of procedure-oriented criteria for determining the required number of filtration iterations of non-stationary non-periodic signals by the multi-iterative method of the moving average with an increasing width of the filtering window on an instance of pulses of voltage on the plasma-erosive load and of current in it had fulfilled. Two main groups of criteria are considered which are based on a comparison of the signal at the current iteration of its filtering either with the signal at the previous iteration or with a reference signal. Also criterion which has properties of criteria of both these groups is considered. The low effectiveness and nonuniversality of the known criteria is shown. New objectively-oriented criteria for the

necessary and sufficient number of iterations of filtering non-stationary non-periodic signals, adaptive to the requirements for further signal processing, are proposed and an analysis of their effectiveness had fulfilled. References 13, figures 2, tables 4.

Key words: non-stationary non-periodic signals, multi-iterative methods of signals filtering of, criteria necessary and sufficient number of iterations.

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References

1. Baskakov S.I. Radio engineering circuits and signals. Moskva: Vysshaia shkola, 1988. 448 p. (Rus)
2. Goronovsky I.S. Radio engineering circuits and signals. Moskva: Radio i sviaz, 1986. 512 p. (Rus)
3. Davydov A.V. Signals and Systems. Lectures and practical work on the PC. Introduction to Signals and Systems Theory. Available at: http://geoin.org/signals/index.html (Accessed 06.02.2017). (Rus)
4. Zagretdinov A.R., Busarov A.V., Busarov V.V. Comparison of methods for stopping sifting in the empirical mode decomposition of signals. *Inzhenernyi vestnik Dona*. 2015. No 3. Available at: http://www.ivdon.ru/ru/magazine/archive/n3y2015/3238 (Accessed 06.02.2017). (Rus)
5. Matveyev Yu.N., Simonchik K.K., Tropchenko A.Yu., Khitrov M.V. Digital processing of signals. Sankt-Petersburg: S-PbNIU ITMO, 2013. 166 p. (Rus)
6. Tsidelko V.D., Yaremchuk N.A. Measurement uncertainty. Data processing and presenting

the measurement result. Kyiv: Politekhnika, 2002. 176 p. (Ukr)
7. Shydlovska N.A., Zakharchenko S.M., Cherkaskyi O.P. Comparison of the smoothing efficiency of signals of voltage on the plasma-erosive load and its current by multi-iterative filtration methods. Tekhnichna Elektrodynamika. 2017. No 4. Pp. 3–13. (Ukr)
8. Huang N.E., Shen Z., Long S.R., Wu M.C., Shih H.H., Zheng Q., Yen N.-Ch., Tung C.C, Liu H.H. The empirical mode decomposition and the Hilbert spectrum for nonlinear and non-stationary time series analysis. *Proc. R. Soc. London A, Math. Phys. Sci.* 1998. Vol. 454. Issue 1971. Pp. 903–995.
9. Kabir M.A., Shahnaz C. Denoising of ECG signals based on noise reduction algorithms in EMD and wavelet domains. *Biomedical Signal Processing and Control*. 2012. No 7. Pp. 481–489. DOI: https://doi.org/10.1016/j.bspc.2011.11.003
10. Karthikeyan P., Murugappan M., Yaacob S. ECG signal denoising using wavelet thresholding techniques in human stress assessment. *International Journal on Electrical Engineering and Informatics* . 2012. Vol. 4. No 2. Pp. 306–319. DOI: https://doi.org/10.15676/ijeei.2012.4.2.9
11. Komaty A., Boudraa A.O., Augier B., Daré-Emzivat D. EMD-Based Filtering Using Similarity Measure Between Probability Density Functions of IMFs. *IEEE Transactions on Instrumentation and Measurement* . 2014. Vol. 63. No 1. Pp. 27–34. DOI: https://doi.org/10.1109/TIM.2013.2275243
12. Sadooghi M.S., Khadem S.E. A new performance evaluation scheme for jet engine vibration signal denoising. *Mechanical Systems and Signal Processing*. 2016. Vol. 76–77. Pp. 201–212. DOI: https://doi.org/10.1016/j.ymssp.2016.01.019
13. Yang G., Liu Y., Wang Y., Zhu Z. EMD interval thresholding denoising based on similarity measure to select relevant modes. *Signal Processing.* 2015. Vol. 109. Pp. 95–109. DOI: https://doi.org/10.1016/j.sigpro.2014.10.038

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