THE APPLICATION OF WAVELET ANALYSIS TO MEASURE DISTORTION POWER GRID

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The widespread introduction of electricity consumers with non-linear characteristics and consumers with key modes leads to a slowdown in the voltage and current power grid. The presence of such distortions worsens the quality of electric energy and causes significant economic losses.

Given the exceptional importance of maintaining high quality electricity, its performance is regulated by international [1, 2] and state [3] standards. Different methods of measuring its parameters are used to monitor the quality of electricity. One such method is a wavelet analysis that gives the representation of measured signals in the frequency domain, which significantly increases the resolution of the analysis, compared with traditional methods of analysis.

In contrast to the Fourier analysis, where the decomposition of a signal is carried out over sinus and cosine functions of infinite duration, in wavelet analysis the signal is decomposed by vibrational functions of finite duration, the so-called wavelets. This makes it possible to trace the change in the spectral components of non-stationary signals in time, that is, the resolution of such analysis in time is ensured. Frequency resolution is provided by stretching, or by compressing the support oscillating function of finite duration, which has received the name of the maternal function. At the same time, increasing the resolution both in frequency and time, in accordance with the principle of uncertainty Heisenberg, it is possible only to a certain limit. Choosing a form of maternal function can be as close as possible to this limit. The increased accuracy of wavelet analysis allows you to identify the causes of distortions and develop ways to eliminate them.

The distortion voltage and current electricity network and wavelet analysis of these distortions were modeled in an environment Matlab / Simulink. The results of computer simulation showed the high resolution of wavelet analysis, which makes it possible to measure energy quality indices with high accuracy.

References:

1. IEEE Std 1159–2009, IEEE Recommended Practice for Monitoring Electric Power Quality; IEEE Power & Energy Society: New York, NY, USA, 2009.

2. CEI/IEC 61000–4-30 International Standard. Testing and Measurement Techniques—Power Quality Measurement Methods, 1st ed.; International Electrotechnical Commission: Geneva, Switzerland, 2003.

3. GOST 13109-97 "Quality norms electrical energy in electric power systems, general purpose".