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Katedra Metrologii, Elektroniki i Automatyki

Rozprawa Doktorska

Analiza metrologiczna algorytmów dyskretnej transformacji
falkowej

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SUMMARY OF DOCTORAL DISSERTATION

Metrological analysis of the Discrete Wavelet Transform Algorithms

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The doctoral dissertation presents a method for determining the expanded uncertainty values of output values of measurement chains containing wavelet transform algorithms in their structure. The presented method is universal for any wavelet transform algorithms that process data from the domain of real numbers, regardless of the algorithm parameters used. The error model presented in this work, describing the metrological properties of the measurement chain, enables the description of deterministic and non-deterministic error signals and takes into account the spectrum of the signal processed by the measurement chain in the assessment of its properties. For the purposes of this work, a division into static, dynamic and random error signals was introduced, as well as a division considering the origin of the analyzed signal, distinguishing between own and propagated error signals. The dissertation presents how wavelet transform algorithms process error signals present in the input signal and presents their role in introducing self-error signals. The application of the proposed method for determining the resultant value of the expanded uncertainty is possible in real time, also in case of changes in parameters related to the error model of the analyzed measurement chain, and does not require the use of the Monte-Carlo method for this purpose. In addition to theoretical considerations, the work presents an example of the application of the proposed analysis method, suitable for the case when the designer of the measurement circuit uses an existing implementation of the wavelet transform algorithm and does not have expert knowledge of the operation of algorithms in question. All dependencies presented in the work were verified by simulation, using the Monte-Carlo method, and by measurement, using a measurement chain built for this purpose. The work devotes most attention to discrete wavelet transform algorithms, while the use of the proposed analysis method is also possible in the case of other variants of the algorithm.