SIGNAL PROCESSING ALGORITHMS FOR MEASURING THERMOPHYSICAL PROPERTIES USING TEMPERATURE WAVES METHOD

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In the temperature waves method [1] information about thermophysical characteristics of the studied substance is contained in the parameters of the first harmonic of the temperature wave passed through the sample. Specifically, the main information parameters of the corresponding problem are the initial phase and amplitude of the temperature wave. In addition to these parameters, the calculation requires knowledge of the sample thickness and wave frequency. These parameters are usually determined by standard methods with the necessary accuracy.

Analog-to-digital signal conversion allows you to get a file that contains information about temperature fluctuations over several periods of the temperature wave. Further processing of such a signal should provide a sufficiently accurate estimate of the parameter values, subject to the presence of noise. Optimal processing of weak signals contains the Fourier transform operation [2].

We use several techniques to speed up the analysis. First, with a priori known frequency of thermal waves [3], we set polling frequency of sensors such that a data file contains the same number of samples per period each time. This allows further use of reference tables of sine and cosine signal, without performing their calculation each time and save time during multiple processing. Secondly, we use a personal computer with a multicore processor, which allows us to split the analysis into several parts and process them in parallel. Then the complex amplitude of the temperature wave is determined and the thermophysical characteristics are calculated.

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1. Ivliyev, A.D. High Temp (2009) 47: 737. https://doi.org/10.1134/S0018151X09050162
2. Van Trees H. Detection, Estimation and Modulation Theory. V. 1. // N-Y. John Wiley and Sons, Inc., 1968
3. Chernoskutov, M.Y., Ivliev, A.D. I& Meshkov, V.V. High Temp (2017) 55: 618. https://doi.org/10.1134/S0018151X17030075