International Journal of Automation, Control and Intelligent Systems
Vol. 4, No. 2, 2018, pp. 19-23
http://www.aiscience.org/journal/ijacis
ISSN: 2381-7526 (Print); ISSN: 2381-7534 (Online)

Improvement of Measurement Accuracy on Power-Electrical Objects

Mehdiyeva Almaz*, Ahmedov Vahid

Control and System Engineering Department, Azerbaijan State Oil and Industry University, Baku, Azerbaijan

Abstract

The properties of slippery discrete integrating corrective filtering are studied with respect to the suppression of systematic and random components of instrumental error by computer simulation. With the help of the conducted researches, experimental models of a system for centralized monitoring of the temperature of the hydraulic structure were developed and made; information management system, which is the basis, is developed and implemented by preparing a certain set of information and measurement systems. It has been proven that the optimization of the processes of the exchange (acquisition, transformation, transmission, processing and presentation) of measurement information in the information and measurement system is of paramount importance for improving the metrological quality of measurements, monitoring, diagnosis and identification using existing technical and economic constraints.

Keywords

Information-Measuring Systems, Instrumental Error by Computer Simulation, Digital Measurement, Digital Signal Processing, Instantaneous Value, Quantization Noise, Optimization of the Processes, Corrective Filtering

Received: May 18, 2018 / Accepted: June 24, 2018 / Published online: August 6, 2018

1. Introduction

Any favorite helmets, primers, line tension - sinusoidal harmonic signals. In one harmonic harmony there is one signal. After all, analog bellows weigh the non-sinusoidal signal. The ten represent a sinusoid, consisting of extraordinary nonsense. The harmony of harmony reveals noise and breakthroughs, which are based on the main signal and the notorious heroes. Sufficient measured signals in most cases (80%) are non-sinusoidal. An infinite number of signals of infinite signals is informative, but not always. For greater control and analysis of controlled processes and objects in real time, a large amount of time is required to determine the integral parameters. The aim of the research is to control and improve the efficiency of managing the objects of the development and consumption of electric energy through the transformation and digital processing of nonsinusoidal electrical signals, the development and application of methods and means to improve the accuracy of digital processing. In any case, the process of creating your own software is important for simplifying, reducing time and direct financial costs for its development.

In the context of the ever-increasing demand for information measurement systems, the diversity of their applications and applications, with the growing demands on the quality and efficiency indicators of existing and newly created systems, the task of developing and developing theoretical, methodological and practical aspects of creating a highly efficient information and measurement system is becoming particularly relevant. Efficiency is a complex indicator of the quality of the information and measurement system, reflecting the ability of the system to provide certain technical, economic and operational characteristics when performing measurements, information and logical functions

* Corresponding author
E-mail address: almazmehdiyeva@yahoo.com (M. Almaz)

assigned to it in the automation of a serviced facility.

Currently, many types of microprocessor kits are developed and manufactured by the industry, which ensure the use of digital methods of information processing in control and management systems, but there are analog signals that need to be received, processed, stored and distributed to the user. In this connection, the important problem is the problem of connecting analog objects with digital control machines, in particular, questions of transformations, signal normalization, methods and means of transmitting analog signals over communication lines in the presence of interference, and so on. The use of microprocessors and micro-computers for data collection and control of production processes causes a number of problems of analog-to-digital conversion of signals, which the user must solve.

2. Statement of the Problem

The purpose of this work is to study and develop a converter of parameters of signals of alternating current based on analog-discrete elements, which has improved metrological indicators.

The research is devoted to the analysis of the mathematical model of alternating current signals and methods of digital measurements of their integral parameters. On the basis of the analysis, typical measurement tasks are defined, and instrumental errors in digital measurements of the integral parameters of the alternating current signals are identified. The structure and functional nodes of the analog-to-digital converter for the parameters of the alternating-current signals are proposed, and a method for correcting the additive error of the converter is proposed.

Theoretically, optimization of the processes of exchange (reception, transformation, transmission, processing and presentation) of measurement information in the information and measuring system is of paramount importance for improving the metrological quality of measurements, monitoring, diagnosis and identification with the help of existing technical and economic constraints [1-6]. In the case of an information and measuring system, the solution of optimization problems occurs with considerable difficulties, which in most cases is due to a lack of a priori information about the properties and characteristics of the automation object, measured values, interfering factors, intermediate and final results of solving basic system functions and tasks, and functional nodes of the measuring and computing subsystems. In the synthesis of an optimal information-measuring system and their subsystems operating in a dynamic mode, the problem of overcoming the a priori uncertainty becomes even more acute. At present, when high-precision dynamic measurements become massive, this problem is of interest for the further development of information and measurement technology in general.

Monitoring parameters and diagnostics of energy facilities is an urgent problem of increasing the efficiency of the country's fuel and energy complex. This is due to the fact that the quality of electricity generated by power units and the amount of electricity consumed by power plants ultimately determine the performance indicators of the entire complex.

3. Problem Solution

Intensive research and development is carried out in this direction. However, unfortunately, there is no systematic approach to creating tools for monitoring the parameters of the diagnostics of energy facilities. In this paper, an attempt was made to develop a systematic approach to the development of IIS for the purpose in question. At the same time, asynchronous motors, which form the basis of most electric drives, account for about 40% of global electricity. Any measured value, for example, the mains voltage is a sinusoidal harmonic signal. This signal contains one harmonic. As a result of measuring the analog value, a non-sinusoidal signal is obtained. It is a sinusoidal wave having additional odd harmonics. The cause of these harmonics is the noise and interference imposed on the main useful signal and noisy. Therefore, the measured signals in most cases (80%) are non-sinusoidal [7-11].

The curves of the instantaneous values of continuous signals are the most informative, but not always observable. Therefore, for controlling and analyzing the operation of controlled processes and objects, it is very important to determine the parameters of the integrated signal in real time. The latter characterize the total quantities of substances and energy introduced and obtained in production for a certain period of time, the parameters of the regime and the parameters of the object, which are the average values of the measured quantities, etc. At present, in connection with the development of computer technology, algorithmic methods of increasing accuracy of measurements. They are based on the reception in the process of the functioning of information and measurement systems of additional information, which allows to exclude the influence of errors on the measurement result. Additional information can be obtained due to the presence of structural, temporal or structural-temporal redundancy of information-measuring systems. A distinctive feature of the use of algorithmic methods is the possibility of improving the accuracy of measurement results without improving the metrological characteristics of the initial measuring instruments and systems.

During the drilling of oil wells, certain parameters like temperature, pressure, density, etc. are measured. All these

parameters are processed to obtain additional information. As a result of the experimental measurement data obtained from the tanks, jammed, and before their processing it is necessary to filter these data. The unfavorable influence of nonsinusoidal networks, electrical equipment and electrical appliances on work consists in the following: there are additional losses in electric vehicles, transformers and networks, as well as additional pressure deviations; reduces the service life of insulation of electrical machines and devices; the work of devices of automation, mechanics and communication deteriorates (Figures 1, 2).

Recently, algorithmic methods for increasing the accuracy of measurements, based on the use of mathematical modeling, specialized computer manuals, and the implementation of special algorithms for processing measurement results have been widely developed. The essence of these methods is reduced to obtaining additional information, which makes it possible to implement an algorithm for increasing the accuracy of measurements.

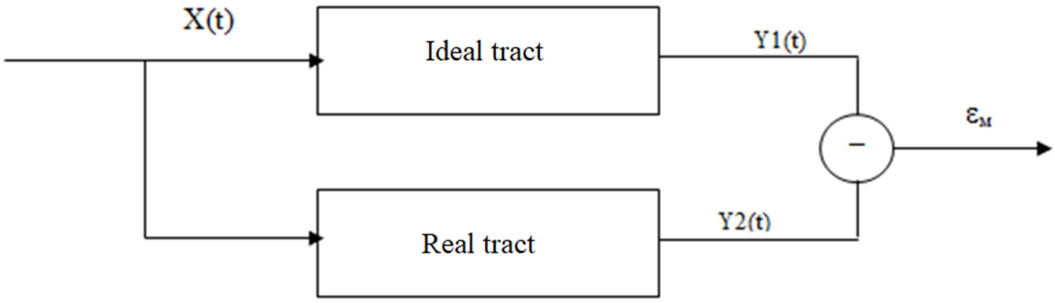
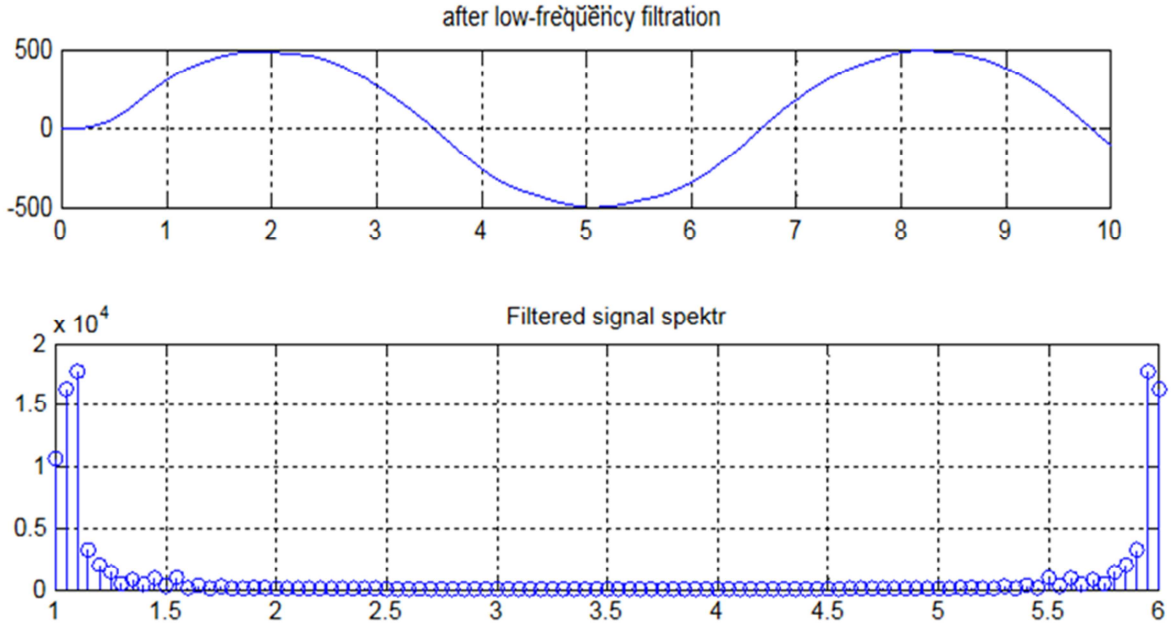


Figure 1. Path of measurement.

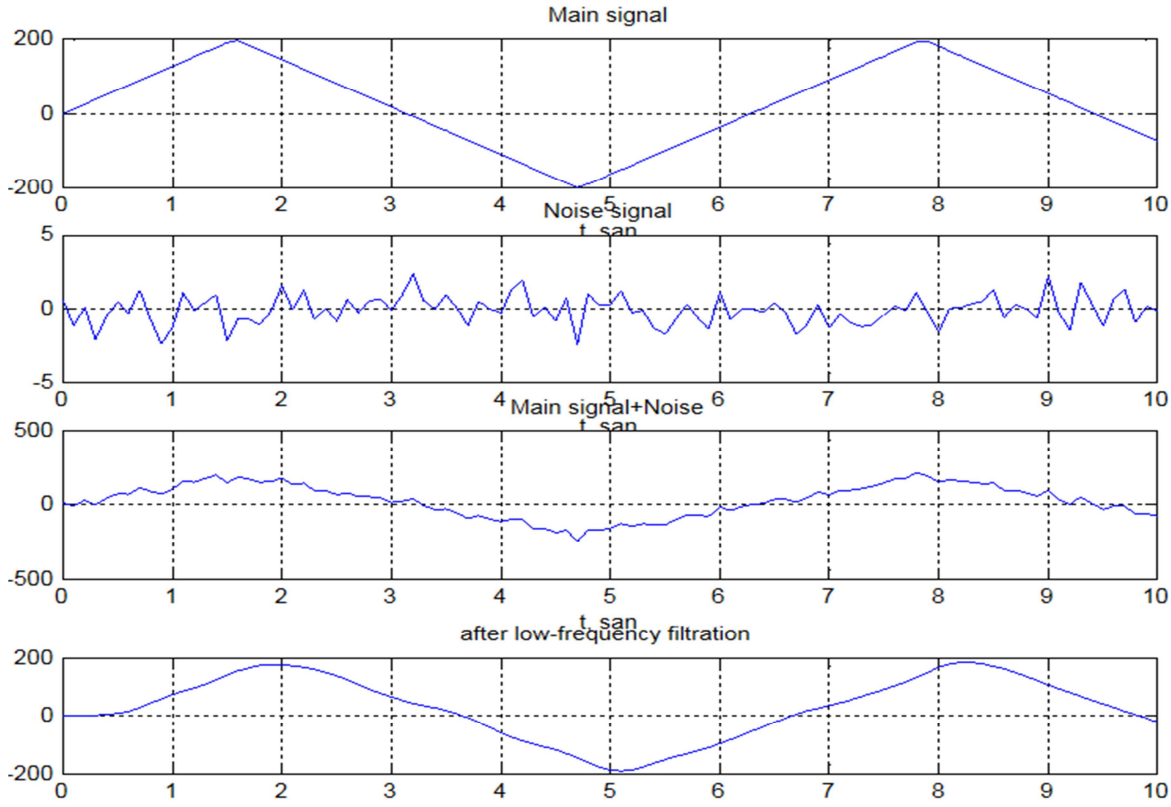
The construction of information and measuring systems based on these methods allows in some cases to ensure high accuracy of results using low-priority initial measuring systems [12-14]. At the same time, the development of algorithmic methods for increasing the accuracy of measurements is carried out in two main directions:

- development of methods for reducing the correlated measurement error component, which combines almost all regular, progressive and slowly varying (relative to the time interval required to implement the measurement algorithm provided by the selected method) of random errors;

- development of methods for reducing the uncorrelated measurement error component combining all high-frequency random errors caused, for example, by the noise of the electronic elements of the measuring transducers that are part of the measuring system.



a)



b)

Figure 2. Filtering results.

It should be noted that the development of methods for reducing the correlated component of the error is of particular importance for the information-measuring system, and not for electrical measurements. This is due to the fact that the accuracy of such an information-measuring system is mainly determined by the accuracy of the primary converters of non-electrical sizes used in them and intermediate unifying measuring transducers for which the correlated errors associated with the assumptions about parts and nodes change the parameters of their transformation functions in time and depending on external conditions, have a predominant significance. Among the algorithmic methods for reducing the correlated components of the measurement error of non-electric dimensions, the most universal and effective are the test methods.

The implementation of these methods provides additional information by measuring the dimensions of tests specially created at the entrance to the measuring systems. The results of test measurements allow using the special algorithms of their processing to determine the current values of the parameters of the static functions of the system transformation and, finally, to exclude their influence on the accuracy of the measurement results of the input measuring systems. The main feature of these methods is that the tests are formed using the most measured measurements. This allows you to not disconnect the measured size from the input of the measuring systems during additional measurements.

Thus, the most universal method is the use of additional measurements of simple additivity and multiplication of tests. However, the effectiveness of the test method for increasing the accuracy of measurements, realized on the basis of additional measurements of simple additive and multiplicative tests, is reduced by using converters with essentially nonlinear conversion functions in test information systems.

Thus, the application of the developed methods for constructing algorithms for the operation of the information-measuring system allows, along with the advantages inherent in the test information-measuring system implemented on the basis of simple additive and multiplicative tests, to obtain a number of new qualities in a new update of the test systems.

Kernels from them:

- simplification of work algorithms. Allow to determine the size of the results of additional test measurements used to determine the nonlinear functions of transformations of the information-measuring system;

- a significant reduction in the number of constants used to identify the nonlinear functions of the transformations of the

information-measuring system;

- a significant simplification of the procedure of linear transformation functions of the test of the information and measuring system with nonlinear transformation functions due to the reduction in the number of additional tests necessary for its implementation.

4. Conclusion

Thus, it can be said that the use of the proposed and developed methods for constructing algorithms for the operation of the information and measurement system allows, along with the advantages inherent in the test information and measurement system implemented on the basis of simple additive and multiplicative tests, in order to obtain a number of new qualities and results in the new development of test systems. Based on the studies carried out, experimental models of a system for centralized monitoring of the temperature of the hydraulic structure were developed and manufactured; information management system, which is the basis, is developed and implemented by preparing a specific set of information and measurement systems.

References

[1] Aliyev T. A. Robust Technology with Analysis of Interference in Signal Processing. New-York: Kluwer, 2003. 199 p.

[2] Aliyev T. A. Digital Noise Monitoring of Defect Origin. Springer Science, New York, 2007, 224 p.

[3] Abdullayev I. M., Allahverdiyeva N. R. Correction filter in the means of measurement. Baku: Chashiogli 2005, 184 p.

[4] Gadjiev Ch. M., Isayev M. M. Methods of processing of measurements in IMM for determining the mass of oilproducts in reservoirs. Baku, Elm, 2011, 94 p.

[5] Bruchanov V. A. Methods of improving the accuracy of measurements in industry. M.: Publishing House of Standards, 2001. 108 p.

[6] Gadjiev Ch. M., Isayev M. M. Methods of processing of measurements in IMM for determining the mass of oilproducts in reservoirs. Baku, Elm, 2000, 94 p.

[7] Abdullayev I. M., Allahverdiyeva N. R. Correction filter in the means of measurement. Baku: Chashiogli 2005, 184 p.

[8] Mamedov R. Q. et al. Structural-algorithmic methods to improve the accuracy of measurements. "Problems naftogazovoï promislovosti" Scientific Research Institute of Oil and Gas Industry. "Naftogaz Ukraina", 2010, Issue 8, pp. 229-241.

[9] Melikov Ch. M., Isayev M. M. Pressure measuring equipment. Patent No 99 (001607, class G 01 L 19/00, Industrial property. Official bulletin. 2001, No 1.

[10] Mehdiyeva A. M. et al. Conversion and initial processing errors of measurement results// American Journal of Circuits, Systems and Signal Processing. Vol. 1, No 3, 2015, pp. 56-59.

[11] Mehdiyeva A. M., Mehdizadə E. K. Information-measurement system development for controlling of measurement parameters. Global Standard Journal. Vol. 1 (2): 2014. pp. 030-033.

[12] Mehdiyeva A. M., Mehdizadə E. K. Information-measurement system development for controlling of parameters of measurement. Standart Global Journal of Business Management. Vol 1 (2): March 2014. pp. 030-033.

[13] Sergienko A. B. Digital signal processing. SPb.: Peter, 2005, 604 p.

[14] Allahverdiyeva N. R., Mehdiyeva A. M., Mehdizadə E. K. Increase the accuracy of conversion and digital processing of electrical signals. "Information-measuring and control systems". Moscow, 2010, No. 9, vol. 8, p. 69-74.