

included into 2 instructions on computer-aided acoustic design systems application.

3. The work with the Machine-tool Industry Ministry, its plants and development laboratories promoted the operating equipment modernization positive results shift to the series-produced one.

Let us note that many technological solutions were performed by us taking into account the world's patent novelty. It, naturally, promoted a more active advance of research ideas into production.

References:

1. Cheremnykh N.N. Noise reducing devices for woodworking equipment / Cheremnykh N.N., Chizhevsky M.P. // Design Atlas. Issue 1, - M.: Ministry of Forest Industry of USSR, 1974 – p. 70, Issue 2, 1978 – p. 15.

2. Chizhevsky M.P. Conducting materials on noisiness calculation and anitinoise measures planning at saw and woodworking industries [text]/ Chizhevsky M.P., Cheremnykh N.N.// - M.: Ministry of Forest Industry of USSR, 1978 – p. 367.

3. Cheremnykh N.N. Methods of noise reducing devices construction for radial saw machines of longitudinal and cross sawing with all kinds of actuating elements thrust [text] – M.: Ministry of Forest and Paper Industry of USSR, 1982 – p. 97.

4. Cheremnykh N.N. Scientific basis of noise reducing devices of saw and woodworking industries equipment [text] // Collection of materials of international scientific- technical conference “Social-economical and ecological problems of forest complex” – Ekaterinburg: USFEU, 2003 – pp. 168-170.

5. Sannikov A.A. Vibration and noise of production machines and equipment of forest complex branches [text] / Sannikov A.A., Starzhinsky V.N., Kutsubina N.V., Cheremnykh N.N., Sivakov V.P., Vikharev S.N. – Ekaterinburg: USFEU, 2006 – p. 484.

6. Cheremnykh N.N. Nonregistered accountable factors at reduced noise formation production machines set-up [text] // Cheremnykh N.N., Shestakov A.N. / Woodworking industry, 2007, №4, c. 18-19.

The work was submitted to international scientific conference «Engineering sciences and present-day production», China (November, 26 – December, 4, 2007, came to the editorial office 03.12.2007.

NON-CONTACT INSPECTION OF ROTATING MACHINE PARTS

Kachin S.I., Kachin O.S.

*Institute of Electrical Engineering, Tomsk Polytechnic University
Tomsk, Russia*

Due to safety and economical reasons the interest to diagnostic and monitoring systems is growing rapidly in industry. Besides safety, there are quality control requirements. The greatest attention at machine-building enterprises is paid to quality control of

working surfaces of commutators and contact rings of electric machines [1]. However, the experience shows that the existing quality control is not efficient enough since it is functioning only in steady-state mode with the help of micrometer heads or industrial indicators and does not take into consideration the whole range of centrifugal, vibratory and temperature loads, influencing the commutator in working electric machine.

The majority of existing diagnostic systems are based on vibration diagnostic and they cannot provide information about cross section of rotating part or its surface quality. In order to fulfill these requirements, a diagnostic system ‘MICROCON’ was designed at Tomsk Polytechnic University. This complex is used for non-contact precision control of cross sections of shafts, commutators and contact rings of machines in static and dynamic modes, measurement of linear micro-movements and vibrations of machine parts.

Designed measuring complex has better technical characteristics compare to other systems due to original design of eddy current sensor, patented method of master correction of measurement results and special mathematical processing methods of measurement data. Eddy current sensor of measuring system has a narrow sensitivity diagram which allows differentiate profile levels of commutator plates with tangential dimension of 1.5 mm or wider.

‘MICROCON’ has high protection from external influences (dust, vapor, oil fog, etc.). It allows determination of object micro-movements, specific electric resistances, as well as surface temperature (if temperature via specific electric resistance is known). Non-contact measurement of specific electric resistance is especially important for thin-film structures supervision.

With the help of the designed diagnostic complex and special mathematical processing methods, the unique experimental data concerning the change of commutator profile of high-speed electric machines during the lifetime period, shape and value of bearing vibrations were collected.

References:

1. Ross, W.H.: ‘Condition monitoring of electrical machines in ScottishPower’. IEE Colloquium on Condition, London, UK, 1995, pp. 3

The work was submitted to XIII international scientific conference on Modern Techniques and Technologies, Tomsk, Russia, 2007, came to the editorial office 16.01.2008.

APPLICATION OF MULTIVERSION PROGRAMMING METHODOLOGY TO CONTINUOUSLY DIFFERENTIABLE FUNCTIONS OF SEVERAL VARIABLES

Kotenok A.V.

*Siberian State Aerospace University named after Academician Reshetnev M.F.
Krasnoyarsk, Russia*

In modern nonlinear programming the universal methods allowing solving arbitrary problems have not been elaborated yet. It is conditioned by the fact that real problems of minimization usually differ very much from each other both intrinsically and dimensionally. The basic idea of my research is the elaboration of a system connecting all optimization methods into a single one, so that the advantages of both first- and second-order methods speed and direct search methods universality remained. It is obvious that all the optimization algorithms are of the same specification – they get a function and initial point at the entry, and at the output – return the found optimal point. This property allows us to combine them into one *multiversion system*.

The main idea of the *multiversion programming* is in the introduction of software redundancy due to using several various program modules equivalent on the functional purpose (got the name of *multiversions*), working in time parallel and getting the same data at the entry. The multiversion outputs are conformed by means of a particular multiversion voting algorithm. As a result, all the program module versions operate as an organic whole and return one coherent result irrespective of failures and errors of certain modules. Because of its high efficiency the given method has got a wide spread occurrence and development.

Having applied the multiversion programming ideology to the problem of several variables function optimization, we get the system, in which different optimization methods act as multiversions.

Methods of comparison of multiversions against each other:

- by the function value;
- by the search direction at the last step;

The influence of random search algorithms on the general result:

- the general search speed increases;
- there is no search process circling;

The influence of various voting methods on the efficiency of several variables functions optimization multiversion system:

- the overall majority voting method is invalid;
- the coherent majority voting method shows authentically high results;
- the coherent majority ill-defined voting method shows the best results;
- the weighted voting algorithms often end in results' mismatch when using random search methods;

- the median voting results in the optimization process "circling".

As the carried out experiments showed, the multiversion system of several variables functions optimization doesn't lose its efficiency compared to the best of all methods separately, while in some cases with a complex surface character, functions show even more rapid convergence speed.

It allows using the offered elaboration as a universal method of any several variables continuously differentiable functions optimization while solving academic and practical problems.

The work was submitted to international scientific conference «Innovation technologies», Thailand, February, 20-28, 2008, came to the editorial office 10.01.2008.

CAPACITY ELECTROMECHANICAL SYSTEMS

Lyapunov D.Yu.

Tomsk Polytechnic University

Nowadays capacity electromechanical systems are widely used in such applications as microactuators for high-accuracy drives, accelerometers for automotive control and safety, etc. It is due to the development of thin-film technologies. The theory of capacity devices as a whole has also received a development. A new branch of science – film electromechanics – has appeared [1]. The systems under consideration have small sizes – at least some microns in one direction. It is caused by their rather high value of power capacity at given sizes. This fact determines rather perspective branch of systems' application – transducers of micro-transferences.

This paper deals with a mathematical model of the step-type capacity motor with a rolling rotor. The system is represented in figure 1.

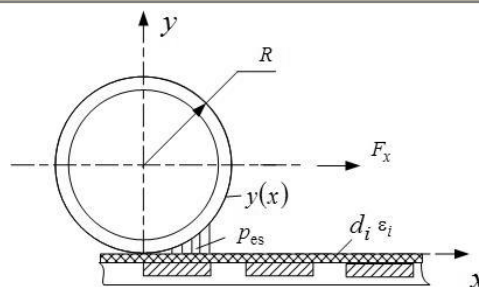


Figure 1. The model of the capacity electro-mechanical system

R – the radius of the rotor, d_i – the thickness of the thin dielectric film on the stator surface, ε_i – permittivity of the dielectric, p_{es} – electrostatic pressure applied to an element of the rotor surface