Energiya o‘lchov strukturasini intellektuallashtirish

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Dolzarblik: energetika muammosi bizning davrimizning global muammolaridan biridir. Ko‘pgina mamlakatlar tizimli energiya tanqisligini boshdan kechirmoqda. Shu munosabat bilan kundalik hayotda va ishda elektr energiyasini oqilona taqsimlash va to‘g‘ri hisobga olish muhim vazifadir.

Maqsad: xatolarni kamaytirishning asosiy usullari ko‘rib chiqiladi: konstruktiv, tizimli va algoritmik. SCP va SCE ikkita tuzilmasi ko‘rib chiqiladi, ular bitta kvadrat bilan ko‘paytirish sxemasi yordamida amalga oshiriladi. Bu ikki kvadratli ikki kanalli tuzilmalarda mavjud bo‘lmagan kvadratiklik tufayli xatoni yo‘q qiladi. Quduq nasoslarining texnik holatini diagnostika qilish va ularning nosozliklarini aniqlash tizimida ishlab chiqilgan SCPni qo‘llash ko‘rib chiqiladi. O‘zgaruvchan tok zanjirlarining quvvati va energiyasini o‘lchash tizimini intellektuallashtirish masalalari ham ko‘rib chiqiladi.
Usullari: statik quvvat (SCP) va elektr energiyasi (SCE) konvertorlari noan'anaviy va keng qo‘llaniladigan elektromexanik konvertorlarga ega bo‘lgan bir qator inkor etilmaydigan afzalliklarga ega. SCP va SCE quvvat va energiyani to‘g‘ridan-to‘g‘ri va bilvosita o‘lchash uchun ishlatiladi, masalan, neft sanoatida ishlatiladigan quduq nasoslarining sog‘lig‘ini diagnostika qilish tizimida. Turli omillar bilan bog‘liq SCP va SCE xatolarining 10 ga yaqin manbalari mavjud. Xatoning barcha komponentlarini hisobga olish va yo‘q qilish juda qiyin. Shu maqsadda apparat va dasturiy qismlarning intellektual blokini kiritish tekshirilmoqda.
Natijalar: ikkinchi va uchinchi guruhlarning SCP va SCE da o‘zgaruvchan joriy davrlarida quvvat va energiya o‘lchash tizimlarining intellektualizatsiyasini oshirish qulay. Ushbu mikroprotsessorga asoslangan transduserlar moslashuvchan algoritmlarga va yuqori meteorologik xususiyatlarga ega (aniqlik, chiziqlilik, ko‘p qirralilik va boshqalar) va aniq va maxsus o‘lchovlar uchun ishlatiladi. Aytish mumkinki, aqlli SCP va SCE aniqlik, moslashuvchanlik, tarmoqli o‘tkazuvchanlik aralashuvi va tebranishini minimallashtirish bo‘yicha yuqori texnik talablarga javob berishi va ulardan foydalanish oson bo‘lishi kerak
Kalit so‘zlar: intellektualizatsiya, elektr energiyasi, energiya, o‘lchov, statik quvvat konvertorlari, statik energiya konvertorlari

Интеллектуализация структуры измерений энергии

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Актуальность: энергетическая проблема является одной из глобальных проблем современности. Во многих странах наблюдается систематический дефицит электроэнергии. В связи с этим рациональное распределение и правильный учет электроэнергии в быту и на производстве является важной задачей.
Цель: рассмотрены основные пути снижения погрешности: конструктивные, структурные и алгоритмические. Рассмотрены две структуры SCP и SCE, реализованные по схеме умножения с одним квадратором. Это позволяет исключить погрешность из-за неквадратичности, присутствующую в двухканальных структурах с двумя квадраторами. Рассмотрено применение разработанных SCP в системе диагностики технического состояния скважинных насосов и определение их неисправностей. Также рассмотрены вопросы интеллектуализации системы измерения мощности и энергии цепей переменного тока.
Методы: статические преобразователи мощности (SCP) и электроэнергии (SCE) обладают набором неоспоримых преимуществ, которыми обладают нетрадиционные и широко используемые электромеханические преобразователи. SCP и SCE используются как для прямого, так и для косвенного измерения мощности и энергии, например, в системе диагностики технического состояния скважинных насосов, используемых в нефтяной промышленности. Существует около 10 источников ошибок SCP и SCE, связанных с различными факторами. Очень сложно учесть и исключить все составляющие ошибки. С этой целью исследуется включение интеллектуального блока аппаратных и программных частей.
Результаты: интеллектуализация систем измерения мощности и энергии в цепях переменного тока удобно наращивать в SCP и SCE второй и третьей групп. Эти преобразователи на основе микропроцессоров отличаются гибким алгоритмом и имеют высокие метеорологические характеристики (точность, линейность, универсальность и т.д.) и применяются для точных и специальных измерений. Также можно сказать, что интеллектуальные SCP и SCE должны соответствовать высоким техническим требованиям по точности, адаптивности, минимизации полосовых помех и вибраций, а также должны быть удобными в эксплуатации.
Ключевые слова: интеллектуализация, электроэнергия, измерение, статические преобразователи мощности, статические преобразователи энергии

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Intellectualization of energy measurement structure

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Relevance: the energy problem is one of the global problems of our time. Many countries experience a systematic shortage of electricity. In this regard, rational distribution and correct accounting of electricity in everyday life and at work is an important task.

Aim: the main ways to reduce the error are considered: design, structural and algorithmic. Two structures SCP and SCE, implemented according to the multiplication scheme with one squarer, are considered. This allows eliminating the error due to non-squareness, which is present in two-channel structures with two squarers. The application of the developed SCPs in the system for diagnosing the technical condition of borehole pumps and determining their malfunctions is considered. The issues of intellectualization of the system for measuring the power and energy of alternating current circuits are also considered.

Methods: static power converters (SCP) and electricity (SCE) have a set of undeniable advantages that non-traditional and widely used electromechanical converters have. SCP and SCE are used for both direct and indirect measurement of power and energy, for example, in the diagnostic system of the technical condition of borehole pumps used in the oil industry. There are about 10 sources of SCP and SCE errors associated with various factors. It is very difficult to take into account and exclude all the components of the error. For this purpose, the inclusion of an intelligent block of hardware and software parts is being studied.

Results: intellectualization of power and energy measurement systems in AC circuits is conveniently expanded in SCP and SCE of the second and third groups. These microprocessor-based converters are characterized by a flexible algorithm and have high meteorological characteristics (accuracy, linearity, versatility, etc.) and are used for precise and special measurements. It can also be said that intelligent SCP and SCE must meet high technical requirements for accuracy, adaptability, minimization of band interference and vibration, and must also be easy to operate (analog and discrete output, wide temperature range, built-in microprocessor, modular technologies, etc.).

Keywords: intellectualization, electric power, energy, measurement, static power converters, static energy converters

1. Introduction

An energetic problem is one of the most global in the row of contemporary problems. This problem have not solved in many countries yet. The world energy production increases twice during the each 15 years. The volume of the modern electric energy production and consumption reached the dangerous for environment level. Because of this the energetically and ecological problems must be solved together. The global problems are always the many- level problems.

The electric energy problem, at the first, is the problem of the good ensuring in accordance to the modern standard of the production, agriculture transport means etc. by the energy. Because of this the rational expenditure of produced energy and optimal technology of energetic systems exploitation are very important for electric energy saving and preventing of its loses. The right commercial account of electrical energy expenditure is an important problem [I]-[6]. One of the main causes of this expenditure necessity is the constant growing of electric energy using volumes. For this aim the using of opportunities of static power and energy converters that have not a moving and turning parts did not completely realize.

The investigation of existing SCP and SCE have made in many countries during many years. And this question didn't lose the actuality till now.

The economical effect of SCP and SCE can is calculated from the formula:

$$E \geq \frac{C_2 - C_1}{T};$$

where E-an economical effect per year; C_1;, C_2 -the prices of the base and of the new converter; T - the time diapason during which we can give back the cost (in years).

The objects (were the power and energy measured) and the conditions of solving tasks are various. The row of the modern sciences and techniques need the high precision, large frequency diapason of SCP and SCE.

For example, the non- ferrous metallurgy needs a lot of electric energy and here exists the requirement of measurements high precision because of the errors in expenditure measurement will lead to the financial loses. The precision of electrical energy expenditure measurement is important for everyday life of population too.

The creation of the modem SCP and SCE together with the progress in computer technology and

solving the tasks in intellectualization allows making an optimal at1tomatic control in technological processes. In electrical energetic during the meteorological attestation for examination of SCP and SCE (which are using by population in everyday life) and indirect or special types of measurement.

All SCP and SCE in accordance to their technical indexes could be distributed to three groups:

1.The SCP and SCE – comparable simple, safe and chip with the middle level of precision. More often they are using in everyday life. They work by the “hard” algorithm during long time without necessity of help of personal. The devices of this type can be using for –favorable efforts of day with various prices.

2. The SCP and SCE of high precision those have built ir1 accordance to the modern technological requirements and that work by the "soft" algorithm on the base on microprocessor. In SCP and SCE of this group the task of intellectualization can be very important. Unfortunately the most progressive from them are complicated and sometimes have not good precision of other parameters. The decreasing of these errors reaches by the combination of the constructive, structure and algorithmic methods. These SCP and SCE may be used for meteorological attestation of industrial SCP and SCE of lower precision.

3. The SCP and SCE of special aims that allow by means of the power and energy measurement results to make an indirect measurement of one or more physical parameters.

In order to the aim, these converters can be middle or high complicated (with microprocessor devices or without ones). The first and the second groups of SCP and SCE are using for the direct measurement of power or energy, but the last group is using for indirect measurements. For example hen the functional connection between the power or energy and other (magnetically, mechanical, etc.) parameters must be determined.

An example of the third group is the definition of the dynamical characteristics and parameters of magnetic materials in alternate magnetically fields, losses o Hysteresis) by means of the wattmeter method of SCP.

These tasks take part in case of weak, middle strong and strong alternate magnetic fields of various frequencies.

An another example is the control by means of SCP of the electrical energy of mills in metallurgy. The optimal held of technological processes is very important task in metallurgy. The loading of tl1e main drives of mills is one of the main characteristics of chosen technology's affectivity.

The pressure of the metal to the platens, the specific charge of electrical energy - are connected to each together parameters. The SCM must determine the energy-power parameters complex during mills' work and to save the results of measurement on each direction. The dependence of electrical energy expenditure to various technological factors computer-object of control" contour. And one of the most important examples for the last third group is the using of SCP in control and analysis of the bore hole pumps work. Here this question will be consider more exactly

.

2. Methods and materials

During the measurement of the power and energy it is necessary to remember about the set of the important things. The induction counters that are using in a big scale yet for electrical energy measurement (in one- phase and three- phase structures) have a set of defects and some of them are constant. These defects are: the presents of moving parts; the absence of vibration security; not high precision; the dependence of error from the work regime; the deforming of the current and voltages curves.

Also we must remember about the character of power and energy measurement in various aggregates of energetically system and production with the such deforming loads, as the non symmetrical, non- linear, alternate - periodically and also the scheme of three- phase connection (in cases of symmetric and non- symmetric of phases). These loads are: electrolyze production, metal cut machine tools etc. Also too many industries look critically to the quality of electrical energy, and defects in power sources brings to the loses and crushes.

The SCP and SCE have not most of the defects, which are presents in case of electromechanical converters of power nd energy. But the statically counters have own specifically peculates (connected with the technical requirements, work conditions, object of intellectualization and character of loads) which must be remembered.

For the receiving to the informative signal that characters the active power P = UIcosφ, informative signal it is necessary to make a multiplication of alternating voltage U with the active part of the current Icosφ.

The various direct and indirect methods of signals multiplication exists. But these multiplications don't correspond to the necessary requirements.

One of the well known methods of two electrical signals multiplication (in SCP) is an algorithm:

$$z = x \cdot y = 0{,}25\lfloor (x+y)^2 - (x-y)^2 \rfloor .$$

Here we use two square converters. This expression doesn't have a methodical error of multiplication. But really the errors receiving from the difference of the real and ideal squarer's characteristics variety.

The necessity of two squarer's identical characteristics having is one of this multiplication method's defects. Also when the loads of these squarer's are same, the inflt1ence of them to each other is presence here. Because of the destabilization factors, at the first time the temperature, it is not simple to receive the high precision. When the ideal squarer's characteristics various from the real characteristic, the high error of SCP appears. The technological diapason of the square characteristic of nonlinear elements may be big – till 10%.

Also the change of the temperature can be as an influence to the square's characteristics. For to a little increase of precision of the SCP, let's make an adjustment (in accordance to the original conversion function) by means of the regulation elements.

But in this case we have not a radical result too. The precision may be increase after crossing to the scheme with one square [7-10]. But the advantage of the SCP scheme with squarers is in expelling of the instantaneous values of power. It automatically expels the error which exists because of non sinusoidal form of current and voltage curves. Two variants of the schemes with one squarer's were offered. Here expels an error of non identificality of scheme's square characteristics witl1 two squares. The increasing of SCP is making by means of the bit- linear or bit- nonlinear approximation of the square function too and by making of compensation of the temperature error in all districts of square function approximation. By increasing of the number of approximation districts we can increase the precision a lot. But in real condition we use only 10 or 15 districts. The choose of these number connected with the required precision and the diapason of multiplicators changing. For created support less bit- linear square (BLS) with 8 districts thee precision is 0.5 %, for 14 - 0.1 %. And because this the whole error of the scheme is not make the 1 %. The compensation of the temperature error to the maxima1 temperature of + 60 °C) made here too. In the scheme of fig. 1 is shown the first variant of multiplication with one BLS.

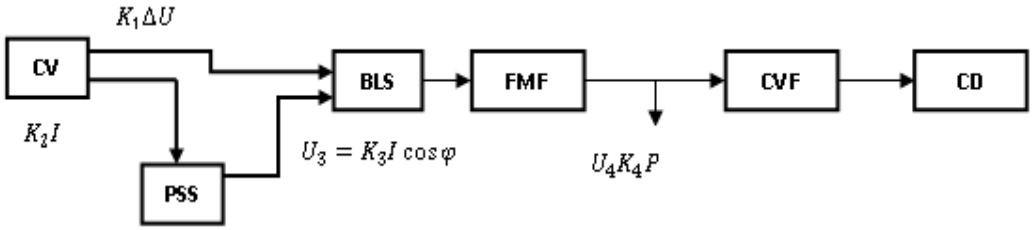

Fig. 1. The structure of the one squarer multiplication scheme

The BLS makes a square conversion like: I=AU2, where U - the input voltage of squarer: I - the output current of squarer: A- is the constant.

If the voltage U changes to the Δu then:

$$I + \Delta I = A(U + \Delta)^2 = A(U^2 + 2U\Delta u + \Delta u^2;$$

$$\Delta I = 2AU\Delta u + A\Delta u^2.$$

If the U is a slowly changing signal of the direct (directed) current and Δu is a small sinusoidal signal an amplitude of that changes and the frequency is constant then we have:

$$\Delta I = 2UU_m \sin\varphi t + AU_m^2 sin^2\omega t = 2AUU_m \sin\omega t + \frac{AU_m^2}{2} - \frac{AU_m^2}{2}\cos 2\,\omega t = I_f + I_0 - I_{2f}.$$

As we can see ΔI consists of the constant I_0 main I_f and with doubled frequency I_{2f} .The voltage of the main frequency U_{out} is a t1seful product of conversion and proportional to the U and Δu , because the composites of the main frequency will not run through the filter of the min frequency (FMF), entered in the PLS's exit:

$$U_{OUT} = I_f = 2ARU_{\Delta \sin\omega t} = CU_{\Delta \sin\omega t};$$

where C- coefficient of all scheme's constants; R- load's resistance.

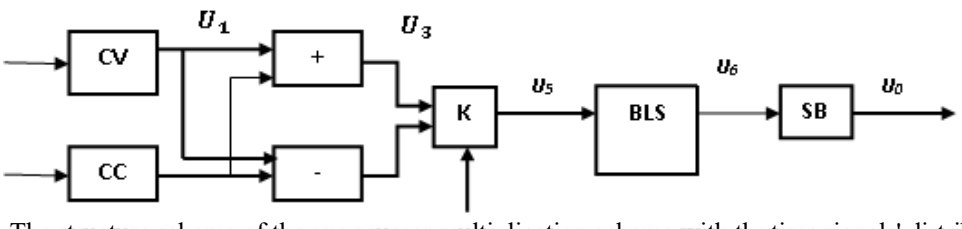

Fig. 2. The structure scheme of the one squarer multiplication scheme with the time signals' distribution

In the second type of the multiplication scheme with one squarer (fig.2), making the time distribu-

tion of signals. In this scheme (as in previous scheme) the error of non identical squires expels too.

In the scheme as in previous scheme the error of non identical squarer's expels too.

Let's consider the work principle of this scheme in the case of two 01 and U2 voltages multiplication where U, and U2 are proportional to the input U and I signals. For the multiplication of these UI and U2 voltages by two- positional electron switch (K) to the input of BLS goes the sum $U_3 = U1 + U2$ and the difference U4= U1 - U2 of these voltages.

The switch K commutates by the commutation voltage Uc. The output U6 voltage of BLS is proportional to U5 :U6 $= U_5^6$U .

Searching blok (SB) which is placed оп the oi1tput of PLS, choice the alternating part of the U5 , which have "meander" character and which then transforms to the sinusoidal signal U0

The frequency of Uc and U0 searches in accordance to Kafelnikov theorem. That's why:

$$U_5 = K_1(U_3^2 - U_4^2)\sin\omega t = K_1(U_3^2 - U_4^2\frac{4}{\pi}(\sin 3\omega t + \frac{1}{3}3\sin\omega t + \frac{1}{5}5\sin\omega t + \cdots);$$

after conversation:

$$U_0 = K_2(U_3^2 - U_4^2)\sin\omega t = K_2[(U_1 + U_2)^2]\sin\omega t = \\ = K_2(U_1^2 + 2U_1U_2 + U_2^2 - U_1^2 + 2U_1U_2 - U_2^2)\sin\omega t = 4\,K_2U_1U_2\sin\omega t,$$

and at least:

$$U_0 = K_3U_1U_2\sin\omega t\,;$$

where K1, K2, Kз - coefficients of proportionality. So, the output signal U0, like in previous scheme is proportional to the multiplication of UI and U2 voltages.

In the both considered schemes of multiplication the received as alternating sinusoidal voltage U0 signal can be easily transformed and amplified by the stabile alternating current amplifier. This is one another opportunity of one-squarer scheme (the two- squarer scheme needs the direct current amplifier which has the drift of zero). Because of the work set point of squarer defined by the measurement voltage U (which changes less than the measured current I) the non square error will be less than in scheme with two squarer's and the diapason of measurement by the angle of phase shift is more wide.

The structure scheme of the created SCP (active power P = UIcosφ) on one PLS without the support voltages which is realizing multiplication algorithm (2) is on the fig1 . After the introduction of 90° shift between the measured U and l the reactive power of circuit Q = UIsinφ is measuring. The scheme contains voltage converter (VC), current converter (CC), PLS and the filter of main frequency (FMF).

Sinusoidal voltage ΔUsinωt is proportional to the alternating voltage on the load U_ but the constant U,which appears on the PSS is proportional to the active part of load current Ucosφ. Then the voltage of the main frequency on the FMF will be proportional to the active power UIcosφ=kP.

On the fig. 1 by the puncture marked the supplementary voltage- frequency converter (frequency of square pulses of constant form) - (VFC) and counting device (CD), which is integrate these pulses in additional counting regime. When we use these supplementary blocks the SCP easily transforms to the SCE. In this case N is the digital equivalent of the electrical energy: W= $\int_1^2$ Pdt

Thus the considered structure scheme is universal. It allows getting the active and reactive power and energy in analog and discrete form by means of the one converter.

3. Results

The requirements for SCP and SCE are various. They are:

- relatively high measurement precision;
- independence on the current and voltage characteristics form; wide frequency diapason on power coefficients;
- low consumption of power from the measurement circuit; small time of measurement;
- safety, economity, small weight - dimension parameters and small price, adaptability to manufacture.

It is a little bit hard to satisfact all these requirements in one converter and may be impossible. Thus for the connect object, technical requirements and work conditions for the functional conversation methods parameters of SCP and SCE structures choosing the optimal solving is finding.

The errors of SCE are determined by the using SCP errors. Let's estimate the main parts of error I accordance to their sources:

- methodical error. Because of the difference between the real squarer's characteristic and exact square characteristic;
- instrumental error of various elements of SCP and SCE;
- error because of non identificality of used in scheme two squarer's characteristics; phase error because of the supplementary shifts of the signals in input circuits (proportional to the current and voltage in controlled circuit);
- frequency error, which appears in schemes with corrective circuits;

- dynamic error, which results in decreasing of SCP's (or SCE's) velocity because of the presence of the passive filter elements in the scheme;
- error because of the non linearity of SCP or SCE conversions characteristics;
- error because of the output circuit's load changing;
- error because of the connecting lines resistance changing for telemeasurement; error because of the influence of the main external factors (temperature, humidity, additional voltage, overloads, etc.);
- error because of the controlled circuit's current or voltage characteristic's deforming.

Above mentioned shows the necessity of the all errors estimation for realization of all requirements on precision and other metrological characteristics.

In the real schemes we must expel or limit some from these errors. Further we shall consider only error because of the non exactness of squarer's. This error describes by the complicated dependence like:

$$\lambda = \mathrm{f}(U_i U_u, \cos\varphi, \mathrm{m}, \mathrm{B});$$

where UI and Uu-the values proportionate to the input current or the voltage of the load; φ- the angle of phase shift between the current and voltage; m- the value, which is describes the difference between the exact squarer's characteristic and conversation function; B- the beta function or Eyler's integral of the first type:

$$B(p,q) = \int_0^1 X^{p-1}(1-X)^{q-1}\mathrm{dx};$$

where indexes p>0 and q>0. Beta-function can be described from the gamma- function.

The beta function may b e also described as:

$$\mathrm{B(p,q)} = \frac{\Gamma(p)\Gamma(q)}{\Gamma(p+q)}.$$

All tacking part errors of SCP are: additive, multiplicative and non linearity error. From their sum we can define the precision of the SCP. The bore hole pumps (BHP) are sing for the oil industry of various regions. The control and diagnostic of them is making by means of the debit's measurement and dynamometring on the low level of the oil industrial factory. Received information about the finding of the errors and crashes sending to another higher level of the structure where it is treated on the computer. But the traditional unconcentration of the rocking machines on the oil fields results by the information loses.

The diagnostic of the BHP makes by the getting of the dynamogramms or wattmetrograms. For the diagnostic by the dynamograme we must have two effort sensors and sensor of angle of turn, which must be placed on the moving parts of the rocking machine.

This method of the dynaшограмм getting is not absolute because of the low safety and BHP's non affectivity.

Vibrations and pushing does disturb the sensors work, which are placed on the moving parts of the rocking machine.Receiving of information about BHP from the wattmetrograms expel the necessity of the conversation of mechanical values to the electrical signal sensors. By the way we receive the signals about the electrical power used by the drive of the rocking machine [8-13].

Also the wattmetrogram shows the state of the whole BHP, not only its underground part (in case of dynamograms). The cycle wattmetrograms of BHP's motor shows information both about deep and ground parts of machine tool.

For the BHP work's analysis the real wattmetrogram is comparing with the first received on the controlled hole. For to receiving of wattmetrograms the SCP of the alternating power convention to the electric signal or code for the entering to the computer is using [4]. The result of right diagnostics depends on the precision, safety and the stability of SCP. As above mentioned the SCP realizing the direct and indirect methods exist. High requirements have SCP's which are working in hard conditions of oil industry (temperature, humidity, vibrations). The cases of the SCP's scheme on the integral elements with the thermo compensation and error's correction have good metrological characteristics: good precision, linear form of conversation function, safety, small weight.

The conversation function…U0 = f(P)…of SCP, made by the scheme from fig.1 is shown on the fig.3 (dependence 1).

On the same fig. 3 shown the conversation function of SCE for the comparison, which is made by the scheme on fig.1 too. This function N = f(W) (where W - electrical energy, N-digital equivalent of energy, that is SCE's results) also has high linear properties and steepness.

The method of HBP wattrnetrogram control allows to optimize holes' work and to make the control of exploitation. By the wattmetrograme we can receive the information about the coefficients of useful acting of underground and ground machine tools. The diagnostic makes by the power's curve.

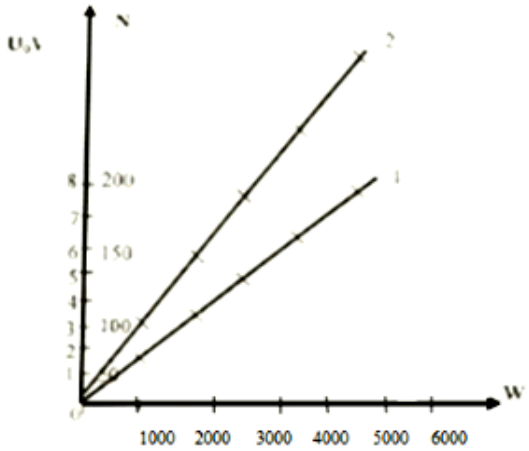

Fig.3. Conversation functions of SCP

The wattmetrograms allows determining the main states of the pump apparatuses for balanced and unbalanced rocking machine which is very important for exploitation. All types of appeared malfunctions shown on wattmetrograms can be delivered on 2 groups:1.progressing malfunctions (fig.4a); 2.crash malfunctions (fig.4b).

The first group includes not filling of the pump and others. The second group includes the breaking of the stangs or reductor and others.

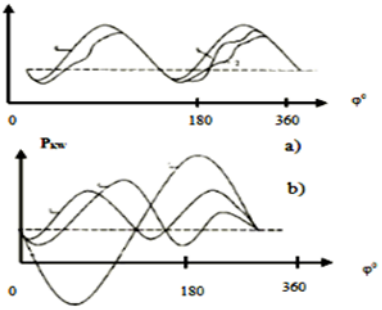

Fig.4. The Curves of the rocking machine motor's power (p) and crank's angel of the turn

Each of these malfunctions brings to the motor's wattmetrograme defect. An analysis of the rocking machine makes from the comparison of real wattmetrogram with the base, received from the same bore hole during the motor's normal work. On the base of SCP the automatic analisator of rocking machine's work can be built. Analisators of centered control system of the rocking machines on the base of microprocessors (MP) or computer have large opportunities and intellectualization of the solving too. An analisator works after the changing of the SCP's output signals and define the type of malfunctions and if it necessary stops the motor of rocking machine. In this scheme the signal from the output of SCP, which is proportionate to the power p goes to the input module (MI) where it converse to the code and entering to the MP. The commutation and analog- digital converter (ADC) are in the MO block. Then the set of the properties is forming and then comparing with the set of the saved in memory set of properties for an interpretation.

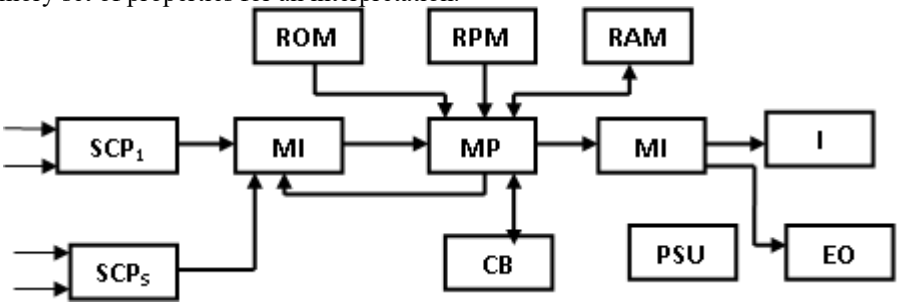

Fig. 5. The structure of the centralized control analyzator of the work of rocking machine group

The results of an analysis through the output module (MO) goes to the indicator (I) and if it is necessary to the control block (CB) which stops the executive organ, (EO); a1so the scheme has the stabilized power unit (PSU). The MP a1lows to choose from the signals the main classes of the pump ap-

paratuses' states: normal work, work without filling of pump. Also the scheme includes the read only memory (ROM), the random access memory (RAM), prograimeable ROM (RPM), other memory devices, using for the saving of operative information, programs, constants which are necessary for an interpretation. The control place allows to change the regime of the workДля приведения этих уравнений к однородному базису узлового метода (узловым напряжениям) требуются эквивалентные преобразования с исключением векторов аварийных токов.

4. Discussion

The development of the integral electronic and algorithmic methods results by the growing of the intellectual potential of information- measurement systems .

An intellectualization of the systems allows creating the new properties of high precision and functional affectivity. An intellectual opportunities allows to rationa1 distribute the measuring and calculating opportunities for to decrease the volume of the sending dates, to make easily the progrщnming process, to make these systems more floppy. An intellectual systems (IS) very often make such operations as approximation, filtration, linearization, correction of errors and results of direct and indirect measurements, and also: testing, repairmen of loosed parts of processes, statistic operations with dates.

The questions of measurement technique's intellectualization connected with the following common directions:

- intellectual converters, devices and measurement systems;
- intellectualization of control and measurement means (diagnostic system, system of date's collection).

Very often the traditional used various parameters of measurement structures doesn't allow all opportunities of calculating technique in measurement systems. Here is very important to use MP mean or one- crystal microcomputers as the including parts of the measurement means.

In the intellectual systems may be two groups of errors [15]:

- the apparatuses errors;
- the errors of calculations.

The errors from the first group are connected witl1 the delay of the measurement time and time of the results output. The second group errors depend on the measurement signals treatment algorithm's precision. Therefore it is important to create the algorithms of the treatment, which will not make complicated the treatment procedure and wil1 improve the result of measurement. For to decrease errors can be used: the method of reduction to the probe converter, the theory of the non exact sets with using of a priory information etc. One of the main properties of the intellectual converters devices and systems (ICDS) is a realization of interactive regime of dates treatment. The second direction of the measurement converters development is increasing of.

Theirs integration with the schemes of the initial treatment, which is increasing of the functions number o-f the converter (receiving of the signal, conversion). The third direction of the intellectual converter's precision increasing is the account of the account of all influence factors (temperature, humidity, vibration). Thus ICDS must improve the results of measurement for comfortable testing by the personal and do an intellectual functions in receiving and treatment of measurement information.

As the result in the ICDS we have the unit of the apparatuses and program parts. An intellectualization of power and energy measurement systems in alternating curve circuits is comfortable to grow in the SCP and SCE of second and third above mentioned groups. These MP -based converters marks by the floppy algorithm and have high meteorological characteristics (precision, linearity, universality etc.) and applied for the exact and special measurements. Also we can say that the intellectual SCP and SCE must be in accordance with high technical requirements on precision, adaptively, minimization of bandy caps and vibrations, and must be comfortable in exploitation (analogous and discrete output wide temperature diapason, built- in microprocessor, module technologies etc.).

5. Conclusion

The SCP and SCE are realizing on the base of the one- squarer of two signals multiplication allow to expel the error because of the non identificality which exists in the scheme with two squarer channels. One - channel scheme expels an additive errors that is useful especially for measurement of small values of power. These SCP and SCE have good precision and good linearity of conversion function. The SCP and SCE prepared on the base of the MP or one crystal microcomputer are from the programmed measurement devices that have large functional opportunities and improved metrological characteristics. Here also solved the problem of intellectualization of the power and energy measurement solving questions. The main constructive task of the SCP and SCE ensuring of the safety of their long time working for various conditions.

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