POSSIBILITIES OF IMPROVEMENT OF MONITORING AND DIAGNOSTIC PROCESS OF POWER ELECTRONIC DEVICES

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The present article consider the possibilities of optimization of the control processes on the basis of Digital Parametric Complex. Its main functional centre is presented as a part of conditions for reliability of the analysis of different break-down processes. A summery is made about the influence of the system of control upon the security of work of the power electronic device. The realized by the complex methods for estimation of the qualitative parameters and the suggested algorithms could be used as basis for working out devices of this type.

Keywords: Power converters, Power Semiconductor, Digital complex, break – down process

The rational use of present Power Electronic Devices (PED) and their effective control are important problems for which decision are necessary precise and profound research. The continuous scheme – constructive improvement and increasing of the quantity of the functional centre in the PED hold back the increase of their reliability and lead to increase of the material time and labour outlay for their technical service. In the elements of a great part of the used nowadays systems are put in conventional methods and ways for control and diagnostic. In this field are taken a lot of examinations directed to the practical use of the great possibilities of the technical diagnosis and working out of effective systems for self testing, self-regulating and automatic control and analysis. The interest towards these problems is a result of the objective increase of the responsibility, difficulty and multifunctionality of modern PED, in conditions of their limited flawless work. The established use of silicon devices in power converters, predetermine their sensitivity toward overwork - short circuits (Sh.C.) overpressure as well as the impossibility for restoration after heat or electric break - down. These requirements are often satisfied by means of great reducing of running processes of devices. This by all means leads to more expensive mechanisms and such of great dimensions. Also firms that produce Power Semiconductor Elements (PSE) guarantee such a duration of their exploitation that coincides with the moral aging of appliances for which they are intended. This means that practically there is no need they to be exchanged, because after their amortization new generations are worked out and introduced. This has sense if we suggest that casual and regular break-down in this type of devices are minimized, their optimal heating, working and climate regime i.e. guaranteed. Because these conditions practically are difficult to be performed because of their impregnability very often it is necessary they to be replaced. If it is impossible to be replaced in many cases

whole apparatus must be rejected. This is technically ungrounded and economically unacceptable. Therefore the examination of working regimes of PSE and working out of methods for optimization and increasing of their exploitation time is an important scientific problem with practical purpose and a great economic effect. In some papers authors suggest various methods or mechanisms for defining of one or more parameters, but they are for one type of devices only. This is an information needed in the process of planning of Power Electronic Device, but there are no facts for particular working regimes after introducing in exploitation. In other words, no matter their popular starting use nowadays their diagnostic insurance in the process of exploitation is at a low technical and technological level. This leads to the following unwanted and economically unprofitable results for the whole PED:

- Many of these devices are used under pressure of overpressure which leads to shortening of their working resource.
- During various repair and remedy work or exchange of PSE there are no necessary optimal heat and exploitation regimes, which leads to a loss of working resources.
- Because of a lack of optimal technical means periodical checking of the technical data are note done even during service. This is a reason some devices to break down before reaching half of their guaranteed exploitation time date.
- Many electronic devices work with lower qualitative parameters because of the use of inaccurate and subjective methods for determination of the whole status, as well as because of the lack of criteria for estimation of their parameters.

Therefore on the basis of upper considerations a Universal Digital - Parametric Measuring Complex (UDPMC) [3] was developed, the need of which is unquestionable.

Due to specialized controllers it is possible to achieve great results in the increase of the effectiveness of the whole system. A complete PED can work by itself and can establish the necessary function, but it is restricted depending of the input logic. The structure can be displayed this way (fig. 1):

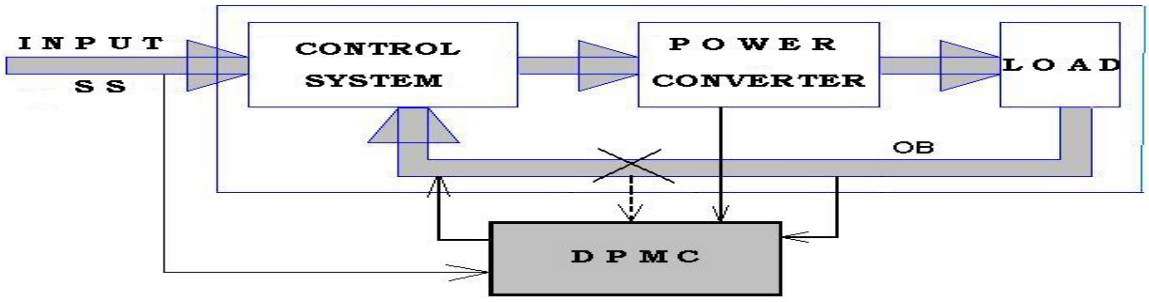

Fig.1. Structural scheme .

Therefore we can note the principle methods of approach in the realization of DPMC:

- On a basis of existing scheme decision and the available System for Operation (SO) the introducing of the complex is realized. The main communication is carried out by the Interface "Power/I" [4] and the main parameters are analyzed depending on the type and use of PED.

• Integrated introduction of the abilities of the complex together with the SO still in the process of initial planning of PED.

Having in mind the existing working converter devices with unfinished resources, the first method of approach which is the basis of the suggested complex is interesting. Analyses of the algorithms is done, the use of which is expedient in the realization of the process of diagnosis. The most important algorithm is a combination of many particular algorithms. They combine the processes of gathering, converting, distributing, digital, arithmetic and logical working up of the gathered information, as well as its presentation in the needed form and manipulation of the work of all devices in the process of carrying out the operations. The methods and rules for working up this type of information are too variable and differ in quality and quantity from each other. As a result too many algorithms are possible in practice, which can give almost equal results by the use of different methods and at the same time they differ by the quantity of the procedures, time of their realization, precision and therefore in their effectiveness and expedience. Having in mind the exploitation and construction peculiarity of the system of control of PED, the algorithms that can be used may be classified by the following indications:

1. *Logical algorithms* - they are on the base of comparison of the controlled parameters with the defined possible limits.

2. *Computing algorithms* - with their help in some cases some mathematical operations as extrapolation and integration are carried out

3. *Adaptive algorithms* - for realization of the function of optimization of the diagnostic process (gathering, converting, distribution and processing of the information) depending on the change of outer factors (parameters are analysed) and the structure of the system and its functional elements. They provide a correction of errors, which additionally optimizes the process.

4. *Parametric algorithms* - typical for them is the preliminary examination of the technical characteristics of the separate elements of the system and defining of the maximum universal of them.

5. *Two - step algorithms* - they analyse two situations of control of the parameters on the principle "norm - no norm" or "fitted - unfitted".

6. *Three - step algorithms* - here the analysis is made by defining three situations on principle "less – norm - more". These algorithms have great possibilities, but they use more procedures.

7. *Many - step algorithms* - here the analysis is done according to the estimation of many situations of the controlled parameters on the principle "less with how much - in norm with what reserve - more with how much".

As a result we can make a conclusion that the choice of the most suitable algorithm and the rational correlation between program methods and apparatus - methods for its realization are the most important factors for optimization of control and diagnostic of the process. On fig.2 are shown the main tasks that the complex can do:

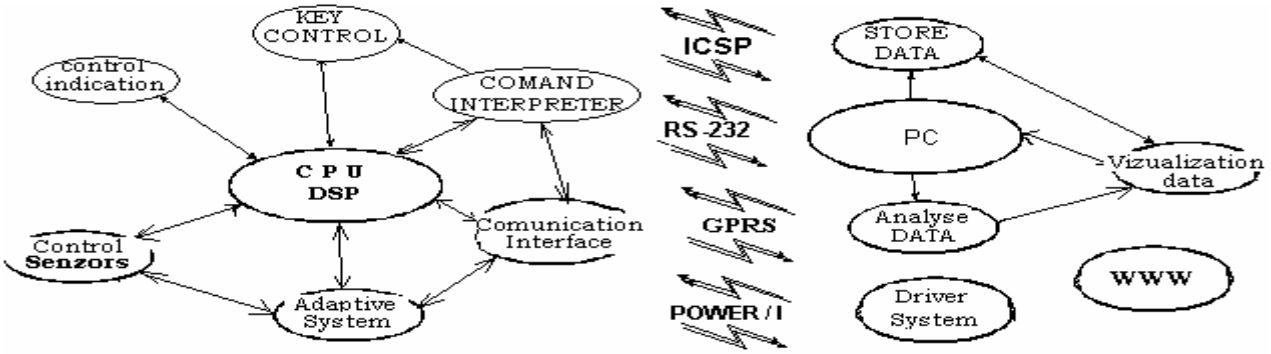

Fig.2 Program model of DPMC.

Interest in the upper model are blocks which purpose define the essence of the complex and its functionality. These are the adaptive system and the GPRS channel. By the first an analysis of the working parameters is ensured in normal regime for respective load. Average parameters are being stored and monitored during work. If diversion of these values occurs an improving effect is worked out and if it is not possible to improve it - we go to a break - down regime of work.

By GPRS - channel the communication with the Personal Computer, which store, process and visualize the gathered data is carried out. A possibility of distant control of PED is provided and also for optimization of working regimes of PSE, as well as for prevention of break - down situations. The complex can be extended with its connecting to the Internet and the abilities that the global network offer can be added. Because of the specific of work of the device the main tasks are separated to several algorithmic schematics. They are not presented in this paper. Fig.3 a summarized algorithm of work of the system. From the done analysis we can conclude that the control of the exploitation process by means of digital and parametric methods is grounded to start together with the development of the PED.

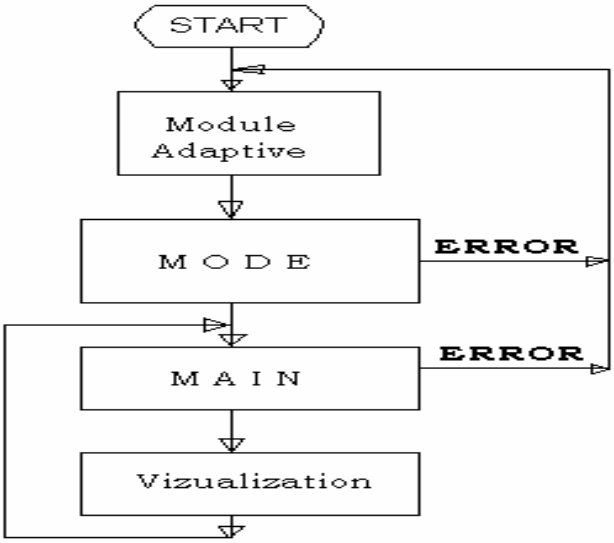

Fig.3 A summarized algorithm of the DPMC.

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