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MATERIALS AND SATELLITE-BASED JOINT CONNECTION EQUIPMENT DETECTION SYSTEMS

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Introduction

Nowadays, data support is an important development factor in all the knowledge fields, which encourages emergence of challenges in which it's impossible to mind all the present conditions identifying the result and at the same time to single out only an approximate set of the most important conditions. Disturbances and condition performance capability can be cited as an example. A result is frequently inexact, and the identifying algorithm cannot be correctly implemented. Elaboration and implementation of connectionist algorithms and of the fault detection systems based on them, is relevant when solving the tasks of this kind.

The connectionist algorithms based on the neural networks, can change their operation depending on the state of their environment. After the analysis of input signals (possibly, together with the demanded output signals), they undergo self-regulation and self-train in order to guarantee a proper reaction. A trained network can be sustainable to some divergences of the input data, which allows it to properly "see" the image containing various disturbances and deterrences [1].

Artificial neural networks, similar to the biological ones, are a computing system with an enormous number of simultaneously operating simple processors with great number of wires. Despite the fact that when constructing such networks, a number of concessions and major facilitations differing them from their biological analogues is usually performed, artificial neural networks demonstrate an incredible number of quantities peculiar to the brain. These are experience-based training, extraction of important data from information overload.

An essential quality improvement of decision-making and satellite equipment nods efficiency can be attained with the help of integrated computer technologies implementation in the form of intelligent heart, as a part of fault detection systems, which will allow to quickly process large datastreams.

The intelligent heart will allow the usage of the most up-to-date forecasting methods used in the materials fault detection systems and satellite equipment nods. Complex networks, including engineering ones, require provision of high-quality of operation and reliability.

Main challenges

When creating the connectionist algorithms, materials fault detection systems and satellite equipment nods, a number of tasks is solved:

1. The task of the object domain formalization, i.e. encoding which includes the list of generic class to which particular materials condition performance capabilities and equipment nods can be related as well as a number of characteristics basically inherent to these objects.
2. The task of training set formation, i.e. the data base which describes particular data used for certification of materials and satellite equipment nods in terms of characteristics. Their rating can also be additionally specified.
3. The task of the fault detection systems training or the task of the object condition determination. The training set is used for the knowledge base formation. Assessment based on the input criteria is being carried out, owing to which one can define the value of each characteristic for the satellite equipment diagnostic in the whole. After this, minor characteristics may be excluded and the fault detection system can be re-trained. This process implies iterances.
4. Quality control. The control is provided owing to coefficient calculation which allows to define the actual average error probability in fault detection for materials and satellite equipment nods.
5. The forecasting task is based on the service-simulating test and allows to obtain corresponding quantitative assessment of the satellite equipment breakdown.

Engineering diagnostic system

Arrangement of efficient operation verification and performance monitoring of satellite equipment (the details, elements, nods, the information translation, processing and storage processes) which is arrangement of technical condition diagnosis processes when in service are one of the important measures of guarantee and maintenance of the technical objects reliability.

The diagnosis algorithm provides for implementation of some conditional or unconditional sequence of certain experiments with the object. The experiment is characterized via a test or operational input and a set of characteristics under control which identify the object's response to the input. Searching algorithms are also included in this system of fault detection in materials and satellite equipment, beside the testing algorithm [2].

Searching algorithms allow to detect the defects which hamper the object operability, its working efficiency or performance accuracy. According to the results of the experiments carried out in conformity with the searching algorithm, one can define which defect of a group of defects (out of the analyzed ones) are found in the object.

When diagnosing the satellite equipment, the defects often appear in the presence of which the relation between the characteristics and the fault reasons, is very ambiguous, simple two-valued figures like "serviceable-1"/"non-serviceable-0" are not sufficient, as clear fault-detection rules in the system are based on the biunique correspondence between the reason and the fault characteristics, which means that they are strictly determinated in terms of rules. That's why the elaborated diagnostic system must detect dangerous conditions of functioning, reasons and a type of the emerged defect.

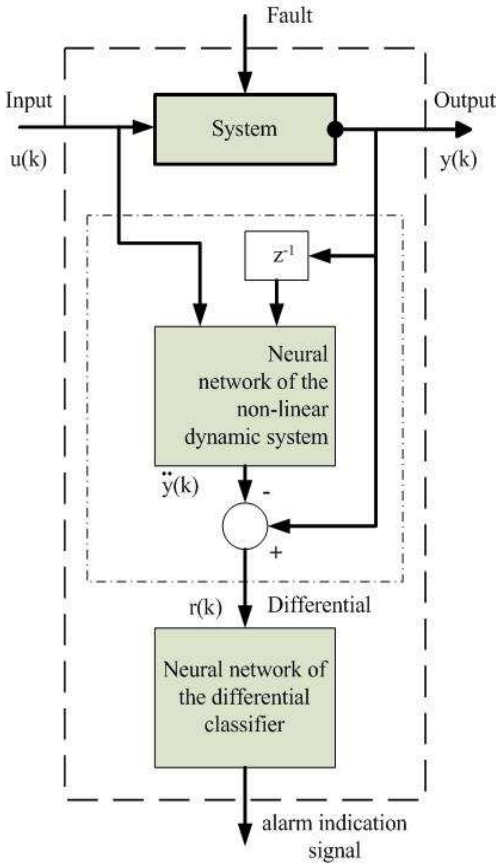

Fig. 1. The structure of an analytical model of fault diagnosis

Besides, the system is expected to provide the information on the evaluation of the remaining operation period of the whole hardware system or its component part.

Thus, the output parameters of the fault detection system must one the one hand detect the reason and the defect (fault) type, and on the other hand – to identify the diagnosis object condition, its conformity to the operational and functional purpose [3, 4].

The analytical models of fault diagnosis identify, single out and classify the faults in the system components. Fig. 1 shows the structure of an analytical model of fault diagnosis.

The first part of the model is a differential identifier which processes inputs and outputs in conformity with a certain algorithm.

The differential signals are formed on its output. The differential must differ from zero in the case of fault and must be equal to zero in the case when there is no fault.

The second part of the model is represented with the fault classifier in which the differentials are assessed for the presence of a fault in the system and a decision on the system outrage is made according to a certain rule.

The operation principle of the fault detection system is presented in fig. 2.

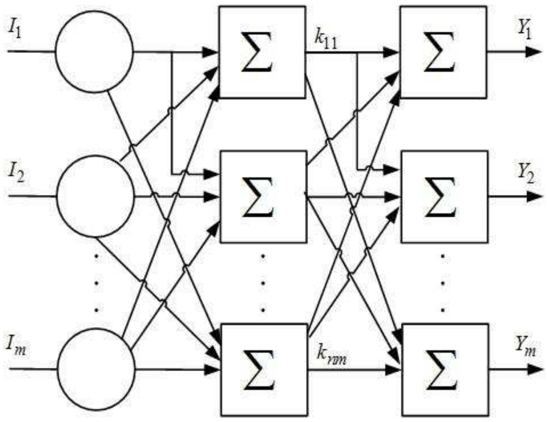

Fig. 2. The operation principle of the fault detection system

On the basis of monitoring of the surrounding conditions of the radiation background, a trained neural system can with fine precision forecast emergence of defects in semiconductor devices and can evaluate the degree of their tenacity which is to timely take out a technical object (robot) of the radiation hazardous exposure zone for its maintenance.

Conclusion

B The fault detection system if materials and satellite equipment nods will allow to monitor the object condition, to diagnose the defects and to forecast its condition by the technical characteristics changes dynamics.

Implementation of this system will allow to find optimal variants of engineering decisions for satellite equipment diagnosis. Besides, it can give forecasts with minimum financial and time expenses for the proper time of a detail or a nod replacement or for the whole object to be sent for repair.

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ОПРЕДЕЛЕНИЕ МАКСИМАЛЬНОЙ СТЕПЕНИ УСТОЙЧИВОСТИ ИНТЕРВАЛЬНОЙ СИСТЕМЫ

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Введение

На сегодняшний день актуальна задача анализа и синтеза систем автоматического управления с нестабильными параметрами. Ими обладают практически все реальные системы, где параметры могут меняться в процессе эксплуатации системы по заранее неизвестным законам или быть недоступными для их точного измерения. Если известны пределы изменения параметров или диапазоны их возможных значений, то такие параметры можно отнести к классу интервально-неопределенных. САУ с таким параметрами получили название интервальных систем автоматического управления.

Система автоматического управления (САУ) предназначенная для управления каким-либо технологическим процессом или агрегатом должна быть работоспособной, а также обладать свойствами, удерживающими параметры в таких пределах, чтобы не происходило существенных нарушений технологических процессов или работы агрегата.

Важнейшей задачей анализа динамических систем управления является решение вопроса об их устойчивости. Для оценки степени устойчивости η – необходимо определить расстояние от мнимой оси до ближайшего корня характеристического уравнения.

Техническое понятие устойчивости систем автоматического управления (САУ) отражает свойство технической системы не только стабильно работать в нормальных режимах, но и при отклонении всевозможных параметров системы от номинала и влиянии на систему дестабилизирующих воздействий, возвращаться к равновесному состоянию, из которого она выводится возмущающими или управляющими воздействиями.

Однако значение степени устойчивости может оказаться недостаточным для конкретной САУ, поскольку время возращения системы в состояние равновесия может оказаться недопустимо большим.

Поэтому одним из широко используемых при проектировании САУ критериев является максимальная степень устойчивости системы. Известно, что системы, синтезированные по этому критерию, при прочих равных условиях, обладают более высоким быстродействием, меньшим перерегулированием и большим запасом устойчивости.

Для задания желаемого качества системы, соответствующего этому корневому показателю, корни должны лежать левее вертикальной прямой, проходящей через точку $(-\eta^*_{max}, j0)$ (рис. 1).

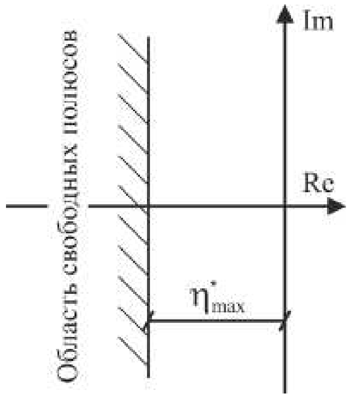

Рис. 1. Расположение полюсов САУ

В условиях эксплуатации параметры системы по тем или иным причинам могут меняться в определенных интервалах (старение, температурные колебания и т.п.) что приводит к искажению вида амплитудных и фазовых частотных характеристик системы. В результате ранее устойчивая система может стать неустойчивой [1].

В связи с этим представляет интерес задача о нахождении максимальной степени устойчивости для интервального объекта. Для решения поставленной задачи предлагается применить коэффициентный метод [2], основанный на использовании коэффициентов интервального характеристического полинома. Данный метод хорошо разработан для анализа стационарных систем и поэтому представляет интерес его робастное расширение.

Постановка задачи

Пусть передаточная функция САУ имеет вид:

$$W(s)=\frac{b}{a_3 s^3 + a_2 s^2 + a_1 s + a_o}, \text{ где } \underline{a_i} \le a_i \le \overline{a_i}$$