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COMPUTER CONTROL SYSTEM OF MECHANICAL HARDENING OF CYLINDRICAL PRODUCTS

Abstract. *The automated system for control work hardening of the surface layers of cylindrical products is developed. The non-contact eddy current transducer as a primary source of information on the extent of the hardened layer is considered. The algorithm of functioning of the system, which based on the limit test parameters depth of the hardened layer, is developed.*

Keywords: *eddy current testing, complex system, the depth of the hardened layer, electromagnetic properties, control object, operation algorithm*

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КОМПЬЮТЕРНАЯ СИСТЕМА УПРАВЛЕНИЯ МЕХАНИЧЕСКИМ УПРОЧНЕНИЕМ ЦИЛИНДРИЧЕСКИХ ИЗДЕЛИЙ

Аннотация. *Разработана автоматизированная система контроля механического упрочнения поверхностных слоев цилиндрических изделий. Рассмотрен бесконтактный вихретоковый преобразователь в качестве источника первичной информации о степени упрочненного слоя. Предложен алгоритм функционирования системы, основанный на допусковом контроле параметров глубины упрочненного слоя.*

Ключевые слова: *вихретоковый контроль, системный комплекс, глубина упрочненного слоя, электромагнитные свойства, объект контроля, алгоритм функционирования*

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КОМП'ЮТЕРНА СИСТЕМА УПРАВЛІННЯ МЕХАНІЧНИМ ЗМІЦНЕННЯМ ЦИЛИНДРИЧНИХ ВИРОБІВ

Анотація. *Розроблено автоматизовану систему контролю механічного зміцнення поверхневих шарів циліндричних виробів. Розглянуто безконтактний вихорострумівий перетворювач як джерело первинної інформації про ступінь зміцненого шару. Запропоновано алгоритм функціонування системи, заснований на допусковому контролі параметрів глибини зміцненого шару.*

Ключові слова: *вихорострумівий контроль, системний комплекс, глибина зміцненого шару, електромагнітні властивості, об'єкт контролю, алгоритм функціонування*

Introduction. Non-destructive testing (NDT) of quality of products is the basic stage of making and exploitation of equipment [1 – 3]. The main questions that must be solved at the construction of eddy current systems of NDT are: a complex approach to obtaining of the primary information about the parameters of the controlled object; automation of equipment of NDT; development of methods and equipment of information processing [4].

The level of development of microprocessor measuring devices have been increasingly associated with the possibility of increase the metrological characteristics of the control, and also of functional possibilities and intellectualization of devices.

It is obvious that the transition to the construction of microprocessor devices of NDT is a major step in the formation of the prerequisites for the development of intellectual devices of control and diagnostics [5].

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Objective of the work. The automated system of continuous control of quality of surface hardening of cylindrical products, which based on the eddy current transducer, will be developed. The informative parameter will be selected and a method of control of the depth of surface hardening in real time according to the generalized normalized parameter, which characterizing the quality of hardening, will be realized.

Basic part. The automated device that implements control of the depth of the hardened layer of products is shown on a Fig. 1. For the construction of this device the standard high precision measurement equipment which is connected to the personal computer (PC) through software-controlled interface was used.

The system comprises the transformer eddy current transducers of transmission type ECT1 and ECT2. The standard sample (SS) is placed in ECT1 and the hardenable object of control (OC) is placed in ECT2. The primary windings of ECT are connected in series-concordantly to each other and connected in series with a resistor R_0 to the generator of output sinusoidal signals G.

This generator allows setting the required amplitude and frequency of the magnetizing current I_m .

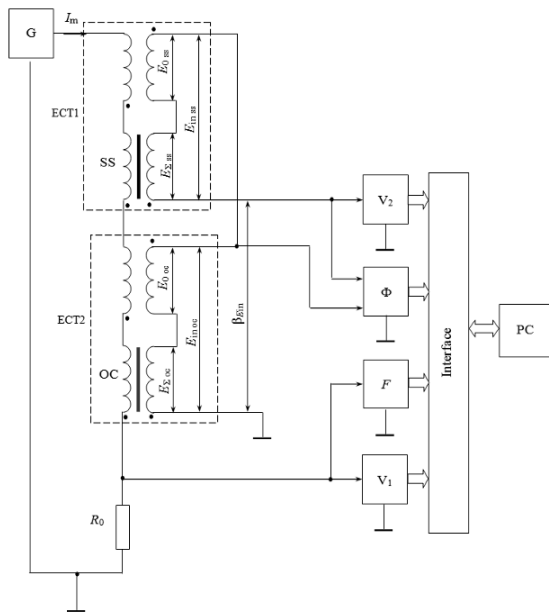


Fig. 1. The automated system realizing eddy current testing

The generator, phase meter, frequency meter and voltmeters through the software-controlled informative channel of the general use by the interface board are connected to the personal computer PC, which is intended to enter the initial data, setting of values of frequency, the magnetizing current, calculating the geometric and electromagnetic parameters of OC, storage and displaying the results of control.

As is well known the theoretical basis of eddy current structuroscopy is the availability of correlation connections between the electromagnetic properties of metals and their chemical composition or structural state [6, 7].

Depending on the type of hardening for concrete materials the time is known after expiration of which on the surface of OC the hardened layer is formed with necessary physico-mechanical properties and depth. To eliminate the influence of technological factors on the result of quality of hardening in works [8, 9], the method, that allows to control by determination of differences β between the measured parameters before hardening and after this procedure, is considered. In the case of achievement β a defined value to k , which set the required norms, the process of hardening is stopped.

Development of the algorithm of functioning is the important step at the construction of the automated eddy current devices [10]. At the choice of algorithm it is necessary to take into account the mode of operations of device, and also to know the amount of measuring and computing operations, the method of determination of the characteristics and time of control.

Fig. 2 shows a block diagram of the algorithm of functioning of device for control of depth of the hardened layer of OC using ECT, which is included in the circuit shown at Fig. 1.

The choice of structure of algorithm of functioning of eddy current device depends on a concrete task. It is possible to apply the considered algorithm for realization of the automated devices of eddy current testing of depth of the

hardened layer of product which that operates in a dynamic mode.

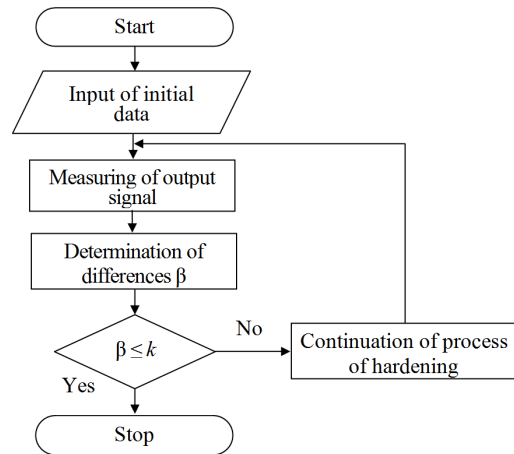


Fig. 2. The algorithm of functioning of the system

Conclusions. The automated complex of eddy current NDT is provided by implementation of the set aggregate of measuring and calculation operations, for each of which on the basis of information about properties of OC, control terms, metrology requirements and restrictions the proper rational algorithm of control of quality of the hardened layer can be chosen.

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