UTILIZATION OF STRAY (FRINGING) FIELDS MATHEMATICAL MODEL IN DEFECTS GROWTH TRACING IN THE MONITORED OBJECTS WITH THE AID OF ELECTRONIC COMPUTER

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The mathematical model of defects fields is suggested on the basis of experimental study of magnetostatic fields of surface defects, describing the field quantitatively from the moment of defects emergence, taking into account the linear parameters of the latter and the magnetic properties of the monitored object. An approach to the solution of defects measurement problems is proposed.

To solve defectoscopy and defects measurement problems the experimental and theoretical research has been carried out at our institute. The experiment was carried out on steel samples with two-dimensional surface defects, the range of defect parameters covered 75 defects. The measurements were taken in applied homogeneous constant magnetic field H_o with the help of special induction coil. The dependences of stray (fringing) fields of defects on magnetizing field value, on defect parameters, on magnetic properties of monitored object, on the observation point position were investigated (1). On topography and variation character the field of surface defect has been estimated to have the field structure of a system of two linear magnetic charges; to estimate objectively defect parameters, one must take into consideration the amplitude of the field and the duration of the field signal (structure field topography and so on (1)). On the basis of extensive experimental data analysis, the field mathematical model of a stretched surface defect with rectangular profile in the form of a system of two hollowed linear magnetic charges (2,3) is suggested. For the magnetic masses of the charges mentioned above, the functional dependences on defect parameters and medium magnetic characteristics were found, while charges arrangement was expressed through defect parameters with respect to defects faces and coordinate system. The values of charges arrangement coordinates were found taking into consideration the mechanism of defect formation in metals and experimental data analysis (3). The mathematical model of hollowed magnetic

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charges can be successfully used to solve the problems of defectoscopy and defects measurement. One can judge upon merits, drawbacks and possibilities of mathematical model from paper (3). Here we single out only on problem among other defect measurement problems: the possibility to trace the defect growth with the help of electronic computer, with analytical expressions fot the field beinq used. Toward this and the problem of defect linear parameters estimation and defect position estimation was solved with the help of measured values of the field characteristic points. Under the given values of H_o, μ and μ_m (2) the measured values of the field characteristic points of the defect are compared with model (digital) equivalent, formed in the computer on the basis of calculation expressions of the model field.

With the aid of vector optimization method (4) one can estimate the correspondence degree between measured characteristic points and digital equivalent, which must be equal to limiting value of defect parameter, but still permit object operation. At the output estimates of defect linear parameters are obtained. Periodically repeated estimation of defect parameters will make it possible to trace the defect development and to predict the moment when defect will be approaching it's limit, which qualifies the defect parameter as being dangerous.

SYMBOLS USED

H_o = magnetizing homogeneous constant magnetic field
μ = normal magnetic permeability
μ_m = maximum magnetic permeability

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