THE METHOD OF DEFECT PARAMETER EVALUATION BY MAGNETIC FIELD

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For a number of magnetic field models of surface defects of crack, riffle and other types the authors succeeded in setting and solving the problem of estimating parameters characterizing co-ordinate position and linear dimensions of defects on the basis of measurements of the components of the magnetic field.

The authors have been working for a long time on the problem of developing convenient for realization on computers and effective in accuracy methods of estimating parameters of defects on the basis of measurements of either components or gradients of components of magnetic field near defects. The first results (1) were obtained by the methods though convenient for realization on computers but insufficiently effective in accuracy and these methods required assigning values of some magnetic characteristics which are difficult to calculate. The further analysis of such models of magnetic fields as the models of F. Förster (2), the models of Arkadyev V.K., the models of I.A. Novikova and N.V. Miroshin, the models of N.N. Zatsepin and V.S. Shcherbinin showed that by means of rather simple mathematical transformations in the above mentioned models one succeds in reducing the problem of estimating parameters of defects to the simplest problem of least squares

$$(Ax - b)^T \cdot (Ax - b) \longrightarrow \min,$$

where x is a vector whose components are simple single-valued functions of unknown parameters of defects and the components of the vector b, and the matrix A depend on the measured values of the components of the magnetic field. The dimensionality of the vector x for all the models does not exceed five. The comparison of the results of estimating parameters of real defects showed that under certain conditions of measurements of magnetic field components the estimates of parameters for all the models almost coincide. Irrespective of the scheme (conditions) of measurements and the type of a model the obtained estimates make it possible to

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discover defects and determine their co-ordinate position accurately. The accuracy of estimating linear dimensions of defects depends on the choice of the model and the scheme of measurements of magnetic field components. To the merits of the obtained solution of the problem of estimating parameters of defects in the magnetic field the authors refer to the simplicity of the mathematical statements, elimination of the necessity of assigning values of the magnetic characteristics of the controlled object, the possibility of estimating an arbitrary number of defects of various types by a single checking and measuring apparatus.

REFERENCES

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