1.2.21. THE CALCULATION MODEL OF ECT SIGNALS FOR SUPERFICIAL AND SUBSURFACE CRACKS CONTROL

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By a basic element, transforming the physical phenomena in an electric signal, at vikhretokovom control and diagnostics, there is a eddy current transmetter (EDT). At planning of EDT for control of defects there is a task of determination of reaction of EDT on distributing of the electromagnetic field in the object of control with a defect. In this work the calculation model of communicating EDT is offered with mirror represented by inducting currents in a cylindrical metal object with a crack defect. In a calculation model there is a magnetizing puttee, measuring device and object represented as separate wires with the proper active resistance, inductance electric and mutual inductance [1]. The algebraic system of linear equalizations, the decision of which is given by a eddy current in the object of control and output tension of measuring puttee of EDT as reaction in the presence of defect, is further made. On a fig. 1 the calculation finite element model of EDT is shown where EDT is schematically presented, object with a superficial crack and distributing of eddy-current current of I_o accepted in a calculation. On a fig. 2 the results of calculations of output signal of EDT are shown on a defect for copper (a) and steel standards (b).

On the axis of the x graphs of fig. 2 the amount of coils of measuring puttee of EDT is postponed, and on an axis y the proper tension on each of coils. From the graphs evidently, that calculated signal of EDT satisfies the known experimental information by thin spools scanning object.

Similar approach is taken at the design of subsuperficial defects, here a control (fig. 3) object appears as a multi-layered structure, the proper eddy-currents of I_o flow in every layer of them. In same queue every layer examined like on separate wires, accepted here, that eddy-current current in the place of presence of crack is equal to the zero. For the decision of this task used similar a previous case correlations of calculations, that does the decision of similar tasks more universal.

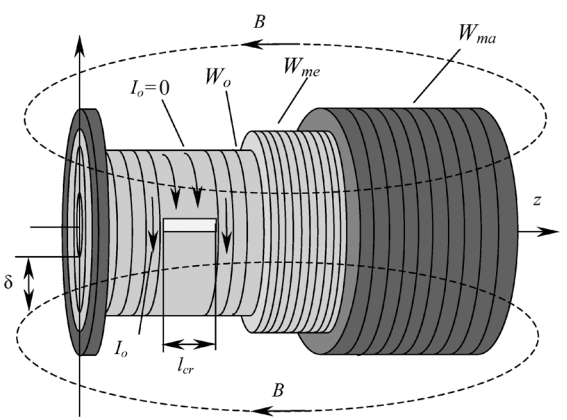

Fig. 1. Model of EDT with a defect in a cylindrical standard

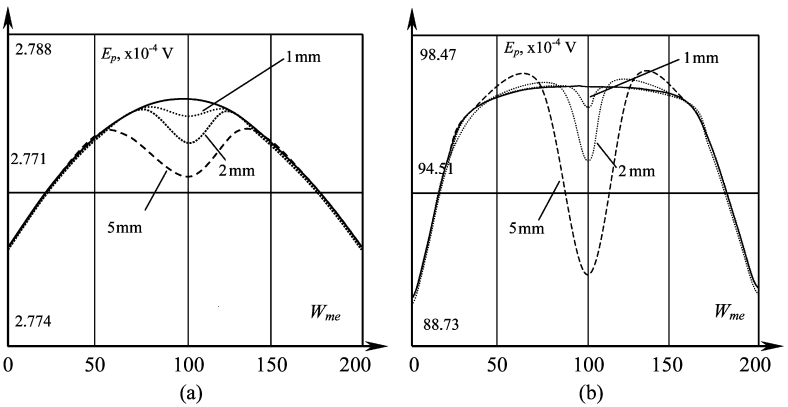

Fig. 2. Tension on measuring puttee of VTP at control of copper (a), steel (b)

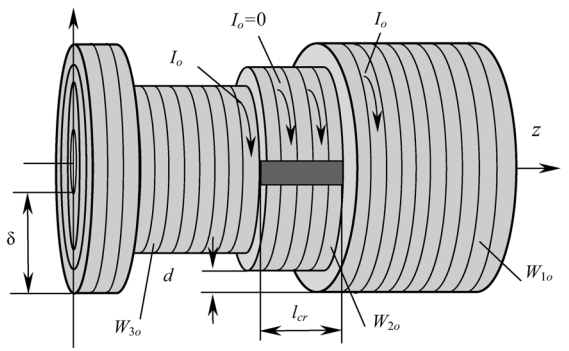

Fig. 3. The multi-layered cylindrical object with a subsuperficial crack

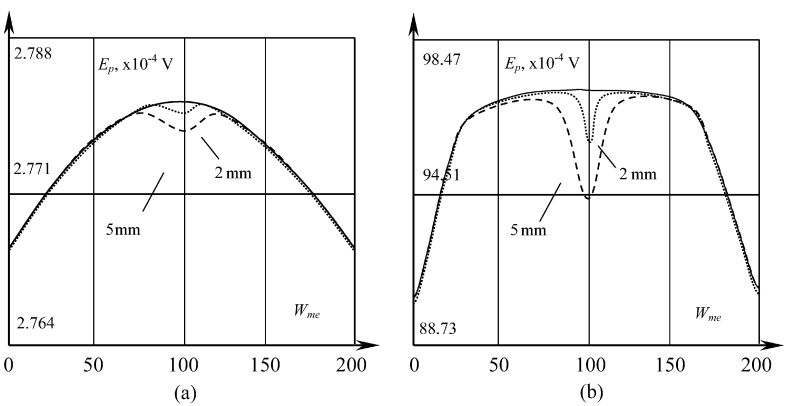

Fig. 4. The signals of outputs of EDT are shown at control of subsuperficial cracks for copper (a) and steel (b) standards

On a fig. 4 the signals of outputs of VTP are shown at control of subsuperficial cracks for copper (a) and steel (b) standards.

From the graph evidently, that at such model of measuring puttee, a signal from its separate coils repeats an in a due eddy-current form in the object of control. The lack of this approach is insensitivity of calculation weekend of signal EDT to the width of superficial crack.

References:

1. **Горкунов Б.М., Тюпа И.В., Тищенко А.А.** Модель вихретокового преобразователя проходного типа с токопроводящим цилиндрическим образцом // Технічна електродинаміка, тематичний випуск "Силова електроніка та енергоефективність". – Київ. – 2007. – Ч. 5. – С. 45 – 48.