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ABSTRACTS

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ON THE ELECTROMAGNETIC FIELD OF A COIL LOCATED ABOVE A MOVING HALF-SPACE WITH VARYING PROPERTIES

VALENTINA KOLISKINA and INTA VOLODKO

Department of Engineering Mathematics, Riga Technical University

1 Meza street block 4 room 146, Riga, Latvia LV 1007

E-mail: v.koliskina@gmail.com,inta.volodko@rtu.lv

Mathematical models for eddy current testing problems are well-developed for the case where properties of the conducting medium are constant and the conducting medium is fixed [1]. In engineering applications some of the parameters that characterize a conducting medium can vary with respect to one spatial coordinate. It is shown in [2] that special treatment of ferromagnetic metals (for example, surface hardening) leads to reduction of the magnetic permeability in a thin surface layer. Experimental data show that the magnetic permeability can be approximated by an exponential function of the vertical coordinate. Blades of gas turbines are usually protected from high temperatures by layers containing aluminium and chrome. The depletion of aluminium in this case can lead to variation of the electrical conductivity with respect to the vertical coordinate (see [3]).

In the present paper we consider a coil with alternating current located above a conducting half-space. The electrical conductivity and magnetic permeability of the half-space are exponential functions of the vertical coordinate. The half-space is moving with constant velocity in a horizontal direction. The system of equations for the x and y components of the vector potential is solved analytically by the method of Fourier integral transforms in the x and y directions, respectively. The system of ordinary differential equations in the transformed space is solved analytically in terms of Bessel functions. The change in impedance of the coil is calculated in closed form in terms of a double integral. Results of numerical computations are presented.

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