MAXWELL DISPLACEMENT CURRENTS IN FIELD THEORY AND IN PRACTICAL APPLICATIONS

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The main purpose of this paper is to demonstrate the possibility of constructing a consistent theory of field and matter within the framework of the continuum methodology and its conservation laws (from the standpoint of the classical Euler, Navier–Stokes, Lame and Maxwell equations). The problems of acoustics, theory of elasticity, hydrodynamics and electrodynamics are considered. The work is based on the fact of the real existence of materialized electromagnetic field lines introduced by Faraday [1] and the fact of the presence of Maxwell displacement currents [2]. In the case of free space, these facts corresponded to the presence of the traditional old ether (in the formulations of the 20th century, the materialization of a physical vacuum or dark matter). Repeating Maxwell's methodological approach, the analogy with classical hydrodynamics is widely used in the work. However, unlike Maxwell's approach, where the case of propagation of only transverse field perturbations is considered, the general case of a field in the presence of longitudinal and transverse waves is analyzed below waves (similar to Prandtl's boundary layer theory).

A unified theory of force fields for gravitational and electrodynamic interaction is also presented. These force fields are described by the unified Hooke-Newton-Coulomb law in the form of the quasi-linear Poisson-Boltzmann equation for the force field potential. The conclusions of the analysis are confirmed by specific practical applications.

In the already traditional approach, the electric field strength $\vec{E}$ is represented as the sum of two terms [3]

$$\vec{E} = -grad\varphi - \frac{1}{c}\frac{\partial \vec{A}}{\partial t},$$

where the first term describes the potential component of the field through the gradient of the scalar electric potential φ, and the second term describes the solenoid (vortex) component of the field through the time derivative of the vector potential $\vec{A}$ of the electromagnetic field. I. e., the vortex component of the electromagnetic field is a consequence of the presence of an "autonomous" solenoid magnetic field. Moreover, the system of Maxwell's equations itself describes only transverse perturbations.

In this paper, the intensity of the electrodynamic field is decomposed into the sum of two terms (potential $\overrightarrow{E_p}$ and solegnoidal $(\overrightarrow{E_s})$) in a slightly different form

$$\vec{E} = \overrightarrow{E_p} + \overrightarrow{E_s} = -grad\varphi + rot\vec{A}$$

and these fields add up to represent a single consistent field. The initial total electric field already has vorticity, which is described by its vector potential $rot\vec{A}.$ The scalar potential through the grad φ operation determines the potential component of the electrical voltage. In this case, we obtain an extended system of Maxwell's equations describing both longitudinal and transverse perturbations, i. e. both potential and solenoidal components of the field (without the paradoxes inherent in modern theoretical physics). With this formulation, a material carrier of the electromagnetic field is introduced, which has its own temperature, density and pressure. This material carrier was previously called ether, currently the names physical vacuum, dark matter, etc. (quintessence, λCDM, dark energy, fifth element, lepton or torsion fields) are used. In our case, the displacement itself acquires a generally accepted real mechanical meaning, becomes a source of force interaction, and its time derivative is a physically tangible velocity.

Let us present some illustrations on the possible structure of electromagnetic waves in free space, Faraday lines of force, and introduced dipole "ultraelement" particles (in the postulated form of dipoles). Here is a demonstration of the propagation of a plane electromagnetic wave in the form of segments of connected dipoles and changes in its electric and magnetic strengths. Figure 1, *a* shows the structure connected dipoles for only one wavelength, in fig. 1, *b*, the distribution of electric and magnetic strengths and the corresponding distribution of pressure perturbation (fig. 1, *c*).

In general, the report substantiates the crucial role of Maxwell displacement currents in field theory and in the practice of propagation of longitudinal-transverse electromagnetic disturbances. The analysis summarizes Maxwell's conclusions and does not contain the paradoxes typical of modern field theory. The applied methodological method is similar to the classical boundary layer theory for the case of motion of a viscous compressible medium. Typical technical and biological examples are considered [4].

References

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