

Publications results for "Reviewer=(ibison)"

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The Kirchhoff gauge. (English summary)

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Citations

From References: 0

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This is a pedagogical survey of the Kirchhoff gauge, with an honest appraisal of the limited physical intuition it conveys.

Kirchhoff first observed that Weber's particular definition of the EM potentials implied the relation $\nabla \cdot \mathbf{A} - (1/c) \partial \phi / \partial t = 0$, called here by the author the 'Kirchhoff gauge'. (Observe the difference in signs between this and the commonly employed Lorenz gauge $\nabla \cdot \mathbf{A} + (1/c) \partial \phi / \partial t = 0$.) Unlike the Lorenz gauge, the Kirchhoff gauge does not result in fully decoupled inhomogeneous differential equations for all four potentials and there is some question of its practical utility. The differential equation for the *scalar* potential ϕ is decoupled from the other three however, and is elliptic rather than hyperbolic. (This may be contrasted with the Coulomb gauge, which eliminates the time derivative of the scalar potential altogether and therefore lies, in some sense, equidistant between the Lorenz and the Kirchhoff gauges.)

The paper gives the transformation to the Kirchhoff gauge from any given set of potentials, which transformation is shown to leave the fields unchanged (as of course it must).

A section of the paper is dedicated to a version of Maxwell's equations with modified definitions of the fields so that each of the four components of the Kirchhoff gauge potential satisfies a decoupled elliptic inhomogeneous second-order differential equation. The author points out that the Kirchhoff gauge is a special case of Jackson's general class of \mathbf{v} -gauge potentials satisfying $\nabla \cdot \mathbf{A} + (1/\sqrt{v^2}) \partial \phi / \partial t = 0$, but with an imaginary velocity $v = ic$.

Reviewed by [Michael Ibison](#)

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