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Macroscopic electromagnetism via complex quaternions

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Quaternions, which are non-commutative but associative, have a great importance in terms of representation of physical systems and mathematical problems in a different way [1, 2]. Many subfields of physics such as electromagnetism, gravitation, magnetohydrodynamics, plasma physics, acoustic, quantum mechanics can be dealt with quaternions. In this work, electromagnetic equations have been studied for macroscopic environments with quaternions forming the generalization of complex numbers in four dimensions. Polarized and magnetized media are great importance for these environments, and there are linearities both electric and magnetic induction fields, respectively [3, 4]. Here, as shown in the notation of tensor, the relation between field and source expressions has been written in a short, different and simple form [5] by defining quaternion induction fields. In addition, electromagnetic energy conservation with induction fields [6] has been derived for the first time by using quaternion algebra under some approaches.

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Зміст