

International scientific conference
**«Algebraic and geometric
methods of analysis»**

Book of abstracts



May 30 - June 4, 2018,
Odesa,
Ukraine

<https://www.imath.kiev.ua/~topology/conf/agma2018>

Macroscopic electromagnetism via complex quaternions

Mustafa Emre Kansu

(Dumlupınar University, Department of Physics, Kütahya, Turkey)

E-mail: memre.kansu@dpu.edu.tr

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.

Acknowledgement: This work has been supported by Dumlupınar University Scientific Research Project, which has Project number DPU-SRP 2017-39.

REFERENCES

- [1] William Rowan Hamilton. *Elements of Quaternions*. New York : Chelsea Publishing, 1969.
- [2] Klaus Gürlebeck and Wolfgang Sprössig. *Quaternionic and Clifford Calculus for Physicists and Engineers*. Chichester : Wiley - Sons, 1997.
- [3] John David Jackson. *Classical Electrodynamics*. USA : Wiley - Sons, 1999.
- [4] David J. Griffiths. *Introduction to Electrodynamics*. New Jersey : Prentice Hall, 1999.
- [5] Mustafa Emre Kansu. An analogy between macroscopic and microscopic systems for Maxwell's equations in higher dimensions. *The European Physical Journal Plus*, 128(12) : 149, 2013.
- [6] P. Kinsler, A. Favaro and M.W. McCall. Four Poynting Theorems. *European Journal of Physics*, 30(5) : 983, 2009.

Зміст

N. Aygor, H. Burhanzade <i>Secondary school students' misconceptions about linear algebra</i>	3
S. Bardyla, H. Kvasnytsia <i>Semitopological graph inverse semigroups</i>	4
B. A. Bhayo <i>On inequalities of generalized elliptic integrals</i>	5
Bodzioch M., Choiński M., Foryś U. <i>A criss-cross model of tuberculosis for heterogenous population</i>	6
Bolotov D. V. <i>Foliations with leaves of non-positive curvature and bounded total curvature on closed 3-manifolds</i>	7
E. Bonacci <i>Algebraic and geometric questions about a 6D physics</i>	9
F. Bulnes <i>Mukai-Fourier Transform in Derived Categories to Solutions of the Field Equations: Gravitational Waves as Oscillations in the Space-Time Curvature/Spin IV</i>	10
H. Burhanzade, N. Aygor <i>A study on the teaching methods in determinants</i>	12
Damla Yaman <i>Order continuity properties of lattice ordered algebras</i>	13
Denega I. <i>Problem on non-overlapping polycylindrical domains with poles on the boundary of a polydisk</i>	14
A. Dudko, V. Pivovarchik <i>Inverse three spectra problem for a Stieltjes string with the Neumann boundary conditions</i>	16
Eftekharinasab K. <i>On the existence of a global diffeomorphism between Fréchet spaces</i>	18
Glazunov N. <i>Class groups of rings with divisor theory, L-functions and moduli spaces</i>	19
O. Gok <i>b-bimorphisms</i>	21
Gül E. <i>On the second regularized trace formula for a differential operator with unbounded coefficients</i>	22
Hentosh O. Ye., Prykaratsky Ya. A. <i>The Lie-algebraic structure of the Lax-Sato integrable superanalogs for the Liouville heavenly type equations</i>	24
V. Herasymov <i>In a natural topological sense a typical linear nonhomogeneous differential equation in the ring $Z[[x]]$ has no solutions from $Z[[x]]$.</i>	26
Juraev D. A. <i>On the Cauchy problem for matrix factorizations of the Helmholtz equation</i>	27
M. E. Kansu <i>Macroscopic electromagnetism via complex quaternions</i>	29
Vladimir V. Kisil <i>An extension of Möbius–Lie geometry with conformal ensembles of cycles</i>	30
Konovenko N., Lychagin V. <i>Rational differential invariants for oriented primary visual cortex</i>	32