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Dual transformations and quaternions. (English) [Zbl 07393690]

Summary: In this study, we are interested in the way quaternions to represent 3D and 4D rotations in Lorentzian space. We give a new method for obtaining a rotation matrix in Lorentzian space with the help of a unit quaternion. Furthermore, we prove that rotation matrices correspond to a quaternion leave invariant the same axis in Euclidean and Lorentzian space. Then, we introduce a semi-orthogonal matrix representation of a quaternion curve in 4D space. Moreover, we provide applications and draw their figures to explore visual representations. Finally, due to the importance of the dual space in kinematics, robotics, and other areas related, we carry this work into their dual spaces by using a dual quaternion.

MSC:
53B30 Local differential geometry of Lorentz metrics, indefinite metrics
53C50 Global differential geometry of Lorentz manifolds, manifolds with indefinite metrics
53B30 Local differential geometry of Lorentz metrics, indefinite metrics
53Z05 Applications of differential geometry to physics
22E43 Structure and representation of the Lorentz group
15B33 Matrices over special rings (quaternions, finite fields, etc.)
15B30 Matrix Lie algebras

Keywords:
dual quaternion; dual transformation; kinematics; Lorentzian space; quaternion; rotation matrix

Full Text: DOI