

Quaternion and Its Application in Rotation Using Sets of Regions

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Abstract

This paper is written to aid the readers to understand application of Euler angles and quaternion in representing rotation of a body in 3-dimensional Euclidean space, \mathbb{R}^3 . Application of quaternion would later require conversion of the quaternion to Euler angles. This is to enable quaternion to be compatible with other applications which use Euler rotation sequence to represent rotation. Thus, a framework to convert a quaternion, which is produced from a random rotation sequence to Euler angles with any specified rotation sequence is proposed and demonstrated here, to aid practitioners to use quaternion in their applications. This will also enable quaternion to be applied in arbitrary sequence onto applications developed using certain rotation sequence of Euler angles. Finally, a program is developed using Matlab-simulink software to demonstrate application of quaternion in maneuvering orientation of a missile flying in 3D space. Six degree of freedom (6DoF) block, which employs Euler rotation sequence of XYZ, is used to aid users to graphically see the maneuvering of the missile's orientation as it flies in 3-dimensional Euclidean space. Quaternion, which is produced from random rotation sequence keyed in by the user, is converted to Euler angles with rotation sequence XYZ by using the proposed method.

Keywords: Euler angles, Quaternion, Rotation sequence, Matlab Simulink, orientation, Gimbal, Gimbal lock, Singularity, Sets of region

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