Parameterization of Finite Rotations

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ABSTRACT

The parameterization of finite rotation is the subject of continuous research and development in many theoretical and applied fields of mechanics, such as rigid structural and multi body dynamics, robotics, spacecraft altitude dynamics, navigation, image processing and so on. This paper introduces the parameterization of rotation, a class of parameterization techniques encompassing many formulations independently developed to date for the analysis of rotational motion. Arbitrary finite motion of a rigid body can be resolved into translation motion linked with same arbitrary selected point and rotation relative to this point .In accordance with the six independent coordinates, describing rigid body motion. Of this three coordinates specify translation of some fixed point, and other three characterize the rotation In this paper we are concerned to rotation relative to some fixed point. Now the solution of any dynamic or kinematic problem when the rigid body cannot be considered as a point, one needs a rational description for the kinematics of the rotational motion. The essential role is played by the parameters. The exponential map of rotations, the rodrigues, cayley, gibbs, wiener, and milenkonic parameterizations all are special cases of parameterization. Out of all parameterizations rodrigues Hamilton parameters are the most convenient parameters. Now rigid body rotational motion can be described by various methods in which the rigid body orientation is determined by the orientation of an orthogonal(Cartesian) coordinate system connected to the body, corresponding to the parameters of rodrigues Hamilton is considered. Rodrigues Hamilton parameters are defined by the finite rigid body vector, now as according to the eulers, finite rigid body rotation are orthogonal transformation is mainly considered in this paper. Finally the derivation of orthogonal transformation equation which are obtained by considering parameters made to use of natural manner of quaternions linked with the description of finite rigid body rotation. Although orthogonal transformation presented in compact manner, all of the obtained equations needed for complete implementation of parameterization of finite rotations.

Key words: Parameters, Orthogonal transformations, finite rotations, equations.