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GENERALIZED ROTATION PARAMETERS FOR THE NONLINEAR ANALYSIS OF ROD AND SHELLS

***Maria de Loudes T. Moreira, Paulo M. Pimenta and Eduardo M.B. Campello**

Polytechnic School at the University of São Paulo
P.O. Box 61548, 05424-970 São Paulo, Brazil
{ppimenta, campello}@usp.br

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ABSTRACT

This work presents a generic formulation of vector-type for the parameterization of large rotations in three-dimensional space. Special distinction is made to the here named "generalized Rodrigues parameters", which result in simple and computationally efficient expressions.

The parameterization is introduced into the rod and shell models of [1,2,3,4,5]. However, in contrast to these works, the weak forms are constructed here with both orthogonal and non-orthogonal projections, corresponding to the application of the virtual work theorem or virtual power theorem respectively (see [6]). We show the pros and cons of each of these projections in connection with the adopted rotation parameterization. Issues as the objectivity of the finite element model, formulas for the rotation composition and the size of the rotation increments are thereby discussed.

The formulation is implemented within a finite element code and assessment of the scheme is made by means of several numerical simulations.

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