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The Error in QR Integration and Applications

Abstract

For the general case of integration of a matrix equation of the form

$$\dot{Q} = f(t, Q), \quad Q(t_0) = Q_0 \text{ orthogonal}$$

for the solution to remain orthogonal $Q^T \dot{Q}$ must be skew-symmetric, hence $f(t, Q) = Q S(t, Q)$ where $S(t, Q)$ is skew-symmetric. In this talk we consider the particular case in which the orthogonal solution is a change of variables that brings a linear time dependent ODE to upper triangular. Our focus is on the global error in approximating the time dependent orthogonal change of variables. Bounds on the global error are obtained that depend on the local error in approximating Q , the non-normality in the upper triangular factor, and on integral separation, a natural condition for characterizing spectral gaps in the time dependent case.