BDF integrators for mechanical systems on Lie groups

Victoria Wieloch (Martin Luther University Halle-Wittenberg), Martin Arnold

Multistep methods of BDF type are the methods-of-choice in many industrial multibody system simulation packages. Matrix Lie groups can be used to describe large rotations without singularities. In this framework, BLieDF is a k-step Lie group integrator for constrained second order systems. Order reduction can be avoided by a slightly perturbed argument of the exponential map for representing the nonlinearity of the numerical flow in the configuration space without any time-consuming re-parametrization.
We compare this integrator with multistep methods on Lie groups suggested by Faltinsen et al. [1] and show the advantages of the BLieDF integrator.

References

[1] S. Faltinsen, A. Marthinsen, and H. Munthe-Kaas, "Multistep methods integrating ordinary differential equations on manifolds," *Applied Numerical Mathematics*, vol. 39, p. 349–365, 2001.