Adaptive time-stepping in Lie group integrators

Brynjulf Owren (NTNU), Charles Curry

We introduce variable stepsize commutator free Lie group integrators, where the error control is achieved using embedded Runge-Kutta pairs. For orders 3 and 4, we are able to obtain such pairs with the minimal number of flow calculations (exponentials). The methods make use of reusal of exponentials from previous stages. We present some numerical examples where we apply the schemes to some well-known problems in mechanics as well as the stiff van der Pol oscillator.