

# Software aspects of Lie group integrators

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A fundamental issue in the construction of object oriented software is the distinction between *specification* and *implementation* (or *what* and *how*). An early motivation behind the investigations of what is now known as Lie group integrators was an attempt to both specify and analyze time integration methods based on coordinate independent (canonical) operations.

Over the last years we have gained a lot of insight into the building blocks of time integrators, where Lie group actions are used to advance the numerical solution. In this perspective classical integrators can be defined as Lie group integrators where the action is the commutative action of shifts on  $\times$ .

Thus the early research in this area did to some degree clarify the basic building blocks of time integrators. However, in the last couple of years the search for more efficient schemes has lead to a diversification of the Lie group integrators. One sees the need to take full advantage of special structures on the domains such as e.g. symmetric spaces and homogeneous manifolds of lower dimension than the group acting upon them. Thus there is now a plethora of different methods, based on various types of coordinates, retractions, various representations of tangent spaces etc.

In this talk we will review software issues in the light of the recent developments in the field. Furthermore we will discuss how the new Lie group algorithms can be incorporated into existing (classical) software for time integration.