Symmetry preserving discretization schemes

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In the past years, the design of numerical integration schemes that allow to retain intrinsic properties of ordinary and partial differential equations, such as symmetries and conservation laws became increasingly popular. In this presentation, we show some methods how it is possible to preserve (continuous) symmetries of differential equations in the process of discretization. That is, these discretization schemes admit the same symmetries as are admitted by the continuous differential equations.

The construction of such schemes is based, e.g. on the computation of moving frames as developed by Fels and Olver (1998) or the combination of differential invariants as introduced by Dorodnitsyn (1991). We illustrate these techniques with some shallow water wave equation and discuss its potential usefulness in dynamic meteorology.