

# Symmetry preserving discretization of differential equations and their numerical applications

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We consider a differential equation (ordinary or partial) and its Lie point symmetry group  $G$ . We then approximate the equation by a difference system on a symmetry adapted lattice in such a manner that the symmetry group is preserved. The group  $G$  transforms solutions of the difference system into solutions and also transforms the lattices. We will report on numerical experiments for several second and third order nonlinear differential equations and show that the invariant schemes provide a much higher precision than standard schemes, without significantly increasing the the complexity of the computations. Moreover, we will show on an example how invariant schemes can provide solutions in the neighborhood of singularities and beyond singularities, where standard numerical methods fail.