1143-65-527 **Melvin Leok*** (mleok@ucsd.edu), 9500 Gilman Drive, Dept. 0112, La Jolla, 92093-0112.
Variational discretizations of gauge field theories using group-equivariant interpolation spaces.

Variational integrators are geometric structure-preserving numerical methods that preserve the symplectic structure, satisfy a discrete Noether's theorem, and exhibit exhibit excellent long-time energy stability properties. An exact discrete Lagrangian arises from Jacobi's solution of the Hamilton–Jacobi equation, and it generates the exact flow of a Lagrangian system. By approximating the exact discrete Lagrangian using an interpolation space and quadrature rule, we can systematically construct variational integrators whose convergence rates are related to the best approximation properties of the interpolation space.

Many gauge field theories can be formulated variationally using a multisymplectic formulation, and we characterize the exact generating functionals that generate the multisymplectic relation. By discretizing these using group-equivariant spacetime finite element spaces, we obtain methods that exhibit a discrete multimomentum conservation law. Lorentzian metric-valued group-equivariant interpolation spaces can be constructed using a generalized polar decomposition. The goal is to use this to construct variational discretizations of general relativity, which is a second-order gauge field theory whose configuration manifold is the space of Lorentzian metrics. (Received August 21, 2018)