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<tr><th>abstract</th><td>Variational integrators are a special kind of geometric discretisation methods applicable to any system of differential equations that obeys a Lagrangian formulation. In this thesis, variational integrators are developed for several important models of plasma physics: guiding centre dynamics (particle dynamics), the Vlasov-Poisson system (kinetic theory), and ideal magnetohydrodynamics (plasma fluid theory). Special attention is given to physical conservation laws like conservation of energy and momentum. Most systems in plasma physics do not possess a Lagrangian formulation to which the variational integrator methodology is directly applicable. Therefore the theory is extended towards nonvariational differential equations by linking it to Ibragimov's theory of integrating factors and adjoint equations. It allows us to find a Lagrangian for all ordinary and partial differential equations and systems thereof. Consequently, the applicability of variational integrators is extended to a much larger family of systems than envisaged in the original theory. This approach allows for the application of Noether's theorem to analyse the conservation properties of the system, both at the continuous and the discrete level. In numerical examples, the conservation properties of the derived schemes are analysed. In case of guiding centre dynamics, momentum in the toroidal direction of a tokamak is preserved exactly. The particle energy exhibits an error, but the absolute value of this error stays constant during the entire simulation. Therefore numerical dissipation is absent. In case of the kinetic theory, the total number of particles, total linear momentum and total energy are preserved exactly, i.e., up to machine accuracy. In case of magnetohydrodynamics, the total energy, cross helicity and the divergence of the magnetic field are preserved up to machine precision.Comment: PhD Thesis, 222 page</td></tr>
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