

Significance and Novelty of this paper

For the first time, structure-preserving numerical methods with the aim to preserve certain invariants or conservation laws of the considered system of nonlinear partial differential equations, have been applied to a model belonging to the class of hybrid MHD-kinetic plasma models. The numerical methods applied in the paper make use of techniques from finite element exterior calculus and geometric electromagnetic particle-in-cell methods. Unlike existing algorithms in the field of MHD-kinetic hybrid models, our presented algorithm features exact conservation of mass, energy and the divergence-free constraint of the magnetic field, leading to the necessary numerical stability in long-term nonlinear plasma simulations.