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An Implicit δf Sub-cycled and Orbit Averaged Lorentz Ion Model BENJAMIN STURDEVANT, SCOTT PARKER, YANG CHEN, BENJAMIN HAUSE, University of Colorado, Boulder — A second order implicit δf Lorentz ion hybrid model with sub-cycling and orbit averaging has been developed to study low-frequency, quasi-neutral plasmas. This model may be useful for verifying gyrokinetic simulation models in applications where higher order terms may be important, for example, in the tokamak edge pedestal region, where the equilibrium gradient scale lengths are quite short. A significant challenge for simulations using Lorentz ions in the presence of a strong guide field is the small time step size requirements for fully resolving the ion gyromotion. In this work, we present a GPU accelerated sub-cycling and orbit averaging method which has been developed to make the Lorentz ion model more viable and has been successfully applied to a test bed model for ion Landau damped ion acoustic waves in a uniform magnetic field. Simulation results will be presented to demonstrate the accurate reproduction of finite-Larmor-radius effects using large macro time steps to advance the fields. Future plans to implement the method in the GEM gyrokinetic simulation code to study the toroidal ITG instability with Lorentz ions will also be presented.

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