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Electrostatic Variational Six-Dimensional Particle-In-Cell Simulation Method on Unstructured Meshes ZHENYU WANG, HONG QIN, BENJAMIN STURDEVANT, CHOONG-SEOCK CHANG, Princeton Plasma Physics Laboratory, Princeton University — We present a novel Particle-in-Cell (PIC) simulation scheme on unstructured meshes for studying low-frequency electrostatic perturbations in magnetized plasmas. In this scheme, ions are treated as fully kinetic (6-dimensional) particles, and electrons are described by the adiabatic response. This PIC scheme is derived from a discrete variational principle [1-3] for electrostatic perturbations on unstructured meshes. To preserve the geometric structure of the system, the discrete variational principle requires that on an unstructured mesh charge is deposited with Whitney 0-forms and the electric field is interpolated using Whitney 1-forms. The new PIC scheme has been implemented on a 2-D triangular unstructured mesh and applied to study Ion Bernstein Waves (IBW). The IBW simulation results agree well with the analytic dispersion relation [4]. The implementation of the algorithm on 3-D unstructured mesh will also be discussed. [1] Squire, Qin and Tang, PoP 19, 08451 (2012). [2] Xiao, Qin et al, PoP 22, 112504 (2015). [3] Xiao and Qin, NF 59, 106044 (2019). [4] Sturdevant, Benjamin, *PhD Dissertation* (2016).

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