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*A General Framework for Electromagnetic PIC Codes*

Problems in plasma physics and beam physics are often studied using a numerical solution of the Vlasov–Maxwell equations based on a Particle-In-Cell (PIC) code which couples a particle method for the Vlasov equation with a grid based Maxwell solver. Special care needs to be taken in the coupling in order to avoid unphysical solutions arising from the violation of charge conservation. An elegant answer to this problem has been proposed by Villasenor and Buneman by an adequate procedure for computing the current density in the case when the Maxwell solver is based on the Yee scheme on a cartesian mesh. In this work, we generalize this method to an arbitrary conformal mesh and a Finite Element approximation of Maxwell's equations where the different components of the solution live in discrete spaces related by an exact sequence property. This Maxwell solver can be of an arbitrary high order of accuracy on meshes composed of both triangles and quads in 2D.

Joint Work with Martin Campos Pinto, Sébastien Jund and Stéphanie Salmon.