

Abstract Submitted
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2D Numerical Model And Self-Consistent Particle-In-Cell Simulations Of Coherent Synchrotron Radiation¹ THOMAS KWAN, CHENGKUN HUANG, BRUCE CARLSTEN, Los Alamos National Laboratory — Understanding CSR effects in a bunch compressor requires accurate and self-consistent dynamical simulations accounting for the realistic beam shape and parameters, transient dynamics and possibly a material boundary. We first extend the well-known 1D CSR model into two dimensions and develop a simple numerical algorithm based on the Lienard-Wiechert formula for the electric field of a stiff beam. This numerical model includes the 2D spatial dependence of the field in the bending plane and is accurate for arbitrary beam energy. It also removes the singularity in space charge field presented in a 1D model. Good agreement is obtained with 1D CSR analytic [1] result for FEL related beam parameters but deviations are also found for low-energy or large spot size beams and off-axis fields. We also employ fully electromagnetic Particle-In-Cell (PIC) simulations for self-consistent CSR modeling. The relatively large numerical phase error and anisotropy in a standard PIC algorithm is improved with a high order Finite Difference Time Domain scheme. Detail self-consistent PIC simulations of the CSR fields and beam dynamics will be presented and discussed.

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