Abstract Submitted
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A Particle-Mesh Method for the Modeling of Synchrotron Radiation from Electron Beams[1] C.-K. HUANG, F.-Y. LI, H. N. RAKOTOARIVELO, P. POMBRIO, B.-S. YEUNG, B.-Q. SHEN, R. GARIMELLA, T.J.T. KWAN, B. E. CARLSTEN, Los Alamos Natl Lab — Coherent and incoherent effects induced by synchrotron radiation, such as the collective beam microbunching instability and phase space diffusion caused by shot-noise in a dispersive beam optics element, are fundamental problems underpinning many of the accelerator design issues. To accurately and efficiently model the beam dynamics in the presence of synchrotron radiation, we investigate several existing methods for the calculation of the radiation near fields, including the finite difference method, the Jefimenko method and a near-field method recently validated where a Lagrangian adaptive mesh and a global mesh are employed[1]. This particle mesh method allows radiation propagation on the mesh with a greatly reduced error. We compare the accuracy and efficiency of these methods in both 1D and multi-dimensions, for the steady-state and dynamical beam trajectories, for the radiation field and space charge field, as well as for the coherent field and the incoherent field. We also discuss the multiple levels of parallelisms inherent in this particle mesh framework, which can be implemented on modern computing platforms using MPI, multi-threading, and GPUs. [1] F. Li, et al., in Proceedings of 10th Int. Part. Acc. Conf., Melbourne, Australia, 2019, pp. 397–399.

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