PARTICLE-IN-CELL MODELING OF RF-GATED THERMIONIC ELECTRON GUNS*

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Self consistent particle-in-cell simulations of RF-gated thermionic guns are presented. Gating is achieved using a gridded cathode, which is driven by an AC voltage source with harmonic content. Simulations using a 700 MHz fundamental frequency suggest it is possible to obtaining high average current (~1 Ampere) short electron bunches (~100 picosecond). The effects of the grid, the electrode configuration, and space charge on the beam emittance are also presented. Both DC and RF accelerating fields are considered. Modeling is carried out using turboWAVE, a fully relativistic, fully electromagnetic, massively parallel particle-in-cell code developed at the Naval Research Laboratory. TurboWAVE contains both electrostatic and electromagnetic modules, and can be run in multiple geometries, including 3D Cartesian, 2D Cartesian, and 2D cylindrical. The code has been enhanced to allow for the possibility of conducting structures within the computational region. The RF grid is fully resolved in order to account for its effect on emittance.

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