Tracking of an Electrostatic Storage Ring Lattice using Map Methods

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January 15, 2016

Abstract

High-order map methods in codes such as COSY INFINITY allow treatment of exact Hamiltonians and very complicated fields, while simultaneously preserving symplecticity in a minimally disruptive way based on Hofer's metric. Lattices can include standard elements, but also customized fields, which we illustrate with a storage ring where exact forms of the fringe fields are known as described and simulated by Metodiev et al.* via numerical integration. The lattice leads to a closed orbit that significantly differs from the axes of the deflectors due to orbit offsets in the fringe fields and other reasons. Symplectic tracking is performed with COSY, comparing accuracy to Metodiev et al.* and a Runge-Kutta-Verner method of order 8(9), showing the speed advantages of symplectic map methods for long-term tracking. We also discuss how more realistic lattices electrostatic lattices where fringe fields are not a priori known can be described in a fully Maxwellian and fully symplectic manner, including a discussion of general electrostatic fringe fields which are showng to qualitatively differ from their magnetic counterparts and are not amenable to description via Enge functions.

Other information

- Main Classification: 05 Beam Dynamics and Electromagnetic Fields
- Sub Classification: Code Developments and Simulation Techniques

References

[*] E.M. Metodiev et al., Fringe Electric Fields of Flat and Cylindrical Deflectors in Electrostatic Charged Particle Storage Rings, Phys. Rev. ST Accel. Beams, 17:074002, Jul 2014.