Abstract Submitted
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Adjoint approach to accelerator lattice design[1] THOMAS ANTONSEN, IRVING HABER, BRIAN BEAUDOIN, University of Maryland, College Park — Traditionally, accelerator lattices are designed using computer codes that solve the equations of motion for charged particles in both prescribed and self-consistent fields. These codes are run in a mode in which particles enter a lattice region, travel through the lattice for a finite distance, and then have their phase space coordinates recorded to assess various figures of merit (FoMs) (emittance, dynamic aperture, etc.). The lattice is then optimized by varying the positions and strengths of the focusing elements. This optimization is done in a high dimensional parameter space, requiring multiple simulations of the particle trajectories to determine the dependence of the confinement on the many parameters. Sophisticated algorithms for this optimization are being introduced. However, the process is still time consuming. We propose to alter the design process using adjoint techniques. Incorporation of an adjoint calculation of the trajectories and self-fields can, in several runs, determine the gradient in parameter space of a given FoM with respect to all lattice parameters. It includes naturally self-fields and can be embedded in existing codes. The theoretical basis for the method and several applications will be presented.

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