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Analysis of Linear Induction Accelerator Physics with Field-Adapted Coordinate Transformations

Wednesday, 10 May 2023 16:30 (2 hours)

We explore the physics of high-current electron beam propagation through the accelerating cells of linear induction accelerators (LIAs), using a field-adapted coordinate transformation that extends the usual rotating Larmor frame analysis to account for simultaneous acceleration. This is useful for LIAs, since the focusing solenoids must be integrated into the accelerating cells to transport the high-current beam, and therefore the axial electric and magnetic fields overlap significantly. Existing LIA analysis methods rely heavily on numerical envelope equations solvers and particle-in-cell (PIC) simulations to track the beam through these fields. While these tools are essential for validating a design or a proposed tune, further insight into the development of such designs or tunes could be gained by developing an improved analytical model of the beam' s propagation through these overlapping fields. By analyzing the beam in a rotating frame with a complex Larmor phase, we seek to develop electric and magnetic field profiles that minimize effects that would increase the beam emittance, such as spherical aberration and parametric amplification of envelope oscillations.

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Footnotes

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Yes

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