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MODIFIED ENVELOPE EQUATIONS WITH CONSIDERATION OF AC-CELERATION AND ITS APPLICATIONS IN BEAM DYNAMICS STUDY

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This research presents a new numerical method of the beam envelope equations in the presence of acceleration. By using a scanning technique, a matched solution set with acceleration has been obtained. With focusing cases as constant wave number per unit length, it is found that the conventional adiabatic approximation theory fails when dealing with high acceleration gradients. Moreover, for matched cases, a scaling law of matched beam envelope as a function of beam energy is derived, which can be applied for the design and optimization for linacs. For mismatch cases, we found that the well-known wave number formula for mismatched envelope oscillations in the low-energy region requires revision when considering acceleration, since the oscillation wave numbers of low energy beams are largely affected by the accelerating effects. By using the Particle-Core Model (PCM) simulations, with acceleration, the amplitudes of particle transverse oscillations near the 2:1 resonance island are dramatically suppressed. This work could have potential applications on analysing and depressing beam dynamical instability with strong accelerating fields in future linacs.

Footnotes

Funding Agency

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Yes

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