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OSCILLATIONS OF MISMATCHED BEAMS IN FODO CHANNELS

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Designers of accelerators for Heavy Ion Inertial Fusion face various challenges because of the strong space charge. Among other things, they need simple, accurate tools for calculating quantities such as the phase advances σ_0 and σ given the lattice and beam parameters. In conjuction with the KV beam model, the smooth approximation [1] is often used. It is simple but not very accurate in many cases. Although Struckmieir and Reiser [2] showed that the stable oscillation frequencies of unbalanced beams could be obtained accurately, they actually used a hybrid approach where σ_0 and σ were given exactly in advance. Starting instead with basic quantities—quadrupole dimensions and field strength, beam charge and emittance—the smooth approximation formulas give substantial errors (10% or more). We previously described an integration method [3] for matched beams that yields fairly simple third-order formulas for σ_0, σ, beam radius and ripple. Here we extend the method to include small-amplitude mismatch oscillations. We derive a simple modification of the smooth approximation formulas and show that it improves the accuracy of the predicted envelope frequencies by a factor of five.

[1]   M. Reiser, *Particle Accelerators* **8**, 167 (1978).

[2]   J. Struckmeier and M. Reiser, *Particle Accelerators* **14**, 227 (1984).

[3]   O. A. Anderson, *Particle Accelerators* **52**, 133 (1996).

Classification: **Beam dynamics and Electromagnetic Fields**

D 01   Beam Optics - Lattices, Correction Schemes, <u>Transport</u>   or

D 03   High Intensity - Incoherent Instabilities, <u>Space Charge</u>, Halos, Cooling