

USPAS summer 2023, Grad Accelerator Physics

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June 13, 2023

Homework #7

Perturbation Hamiltonian: If a magnetic multipole has the magneto-static potential $\text{Im}\{\Psi_n \bar{w}^n\}$, and a short length L , show that the perturbation Hamiltonian is proportional to $\text{Re}\{\Psi_n w^n\}$ and compute its full form.

Path length variations with energy: You are given the 6x6 one-turn transfer matrix, with the dispersion \vec{D} and horizontal 2x2 matrix \underline{M} . What is the time delay of a particle with relative energy deviation δ when it takes one turn along the periodic dispersion η ?

Path length variations with kick angles: You are given the 6x6 one-turn transfer matrix at $s = 0$, with the dispersion \vec{D} and horizontal 2x2 matrix \underline{M} . A corrector coil at that point produces an angle θ . What is the time delay of a particle that takes one turn along the periodic closed orbit produced by this angle?

Lattice Design #7

Asymmetric bump: Implement a 4-bump in your lattice that only changes the angle of the closed orbit at the interaction point, but not its position. Compare the result for the strength of the corrector coils with the formulas you computed in a previous homework.

Cavities: Place 8 cavities into the first straight section, at locations where bends would be in the FoDos. Track particles and plot their longitudinal phase space. Find stable and unstable fixed points, and invariant ellipses in longitudinal phase space.