Homework for Physics 456/656

Introduction to Accelerator Physics and Technology (Hoffstaetter)

Due Date: Thursday, 11/06/03 - 11:40 in 110 Rockefeller Hall

Exercise 1:

Given a FODO lattice which has the periodic Twiss parameters $\beta_x = \beta_y = 10m$, $\alpha_x = \alpha_y = 0$ at its exit.

(a) If you want to construct a symmetric arrangement of six quadrupoles to design an interaction region with a horizontal beta function of 0.5m and a vertical beta function of 0.05m in its center. How would the transport matrix from the FODO to the interaction point have to lock like?

(b) Why are four quadrupoles not sufficient to adjust the two beta functions?

(c) Assume there is also a symmetric arrangement of four horizontal corrector coils and that the Twiss parameters at their places are known. Specify the relative strength of these coils so that a closed bump is created that only changes the orbit position at the low beta point, but not orbit angle.

(d) Specify the relative strength of these coils so that a closed bump is created that only changes the orbit slope at the low beta point, but not the orbit position.

Exercise 2:

Assume you are able to change the strength of all optical elements in a storage ring.

(a) How can you measure β_x and β_y in a quadrupole.

(b) How can you measure the beam position in a sextupole?

(c) Assuming there is a BPM just next to a horizontal correction dipole. How can you measure the horizontal beta function at that position?