Recap 2nd Lecture

Matrix Formalism: Each element i is represented by transfer matrix $\mathbf{M}_i$, trajectory from $\vec{x} = \prod_{i=1}^{n} \mathbf{M}_i \cdot \vec{x}_0$

Matrices (simple approx.): dipole and drift $\mathbf{M}_D = \begin{pmatrix} 1 & L \\ 0 & 1 \end{pmatrix}$ quadrupole $\mathbf{M}_Q = \begin{pmatrix} 1 & 0 \\ \pm 1/f & 1 \end{pmatrix}$

Equations of Motion:

$$x''(s) + \left\{ \frac{1}{\rho^2(s)} - k(s) \right\} x(s) = \frac{1}{\rho(s)} \frac{\Delta p}{p_0}$$

linearization of all terms

$$y''(s) + k(s)\, y(s) = 0$$

Matrices from EQM: build from solution of EQM for individual elements → piecewise solution of EQM

Transverse "Spaces": configuration space (x,y), (horz.) trace space (x,x'), (horz.) phase space (x, p_x)

Beam Size & Divergence: based on 2nd statistical moments: $\sigma_x^2 = \overline{x^2}, \quad \sigma_{x'}^2 = \overline{x'^2}$

(Geom.) Emittance: area/π occupied by the beam in trace space, statistically defined by second moments

$$\varepsilon_x = \sqrt{\overline{x^2}\,\overline{x'^2} - \overline{x\,x'}^2}, \qquad \varepsilon_y = \sqrt{\overline{y^2}\,\overline{y'^2} - \overline{y\,y'}^2}$$