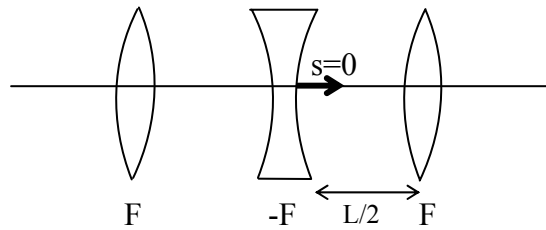


Homework Set #4
(due: Wednesday, February 5, 2003)

1. Consider a F0D0 lattice.



The function $\beta(s)$ in the drift space between the lenses $-F$ and F can in general be written as ($s=0$ at the location of the defocusing lens)

$$\beta(s) = \beta_0 + \beta_1 \cdot s + \beta_2 s^2.$$

In the class, we found

$$\beta_0 = 2F \sqrt{\frac{1-u}{1+u}}, \quad u = L/4F.$$

a) Show that

$$\beta_1 = \beta_0/F$$

$$\beta_2 = \frac{\beta_0}{2F^2(1-u)}.$$

b) Show that the envelope function at the focusing quad is given by

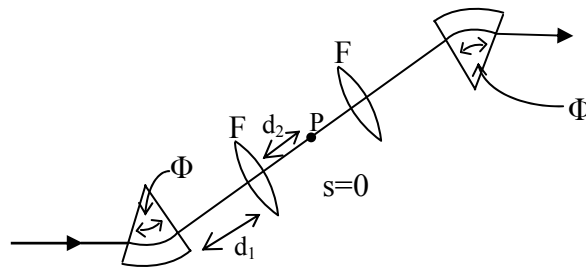
$$\beta(L/2) = 2F \sqrt{\frac{1+u}{1-u}}.$$

c) The phase advance per period may be computed from the integral

$$\mu = 2 \int_0^{L/2} \frac{ds}{\beta(s)}$$

Show that $\sin \mu/2 = u$.

2. Let us design an achromatic translation in x , consisting of two opposite polarity sector magnets with a bend angle Φ and two focusing thin lenses with focal length F .



- It is natural to consider the $C(s)$ and $S(s)$ trajectories reference to the midpoint of the system, P . Sketch these trajectories. From the symmetry of the system, make qualitative statements about the contributions of each trajectory to the dispersion. How is this problem different from the problem of the achromatic bend discussed in the class?
- Calculate the strength of the focal length F that makes $D = 0$ at the exit.