ECE 414 – Spring 2016
Homework #3

Out: 01.21   Due: 01.28

1. Replacing an arbitrary 'black box' ray matrix with a single lens. An optical black box has various optical elements inside it, producing a given real ABCD matrix from its input plane to its output plane. We want to replace this black box with a box of physical length L, containing only a single lens of focal length f. Can this be done? Why? And if so, what total length L, focal length f, and lens location x (within L) will be required?

2. (Exercise 1.4-6)   A Periodic Set of Pairs of Different Lenses. Examine the trajectories of paraxial rays through a periodic system composed of a set of lenses with alternating focal lengths f_1 and f_2 as shown in the figure below. Show that the ray trajectory is bounded (stable) if

$$0 \le \left(1 - \frac{d}{2f_1}\right)\left(1 - \frac{d}{2f_2}\right) \le 1$$