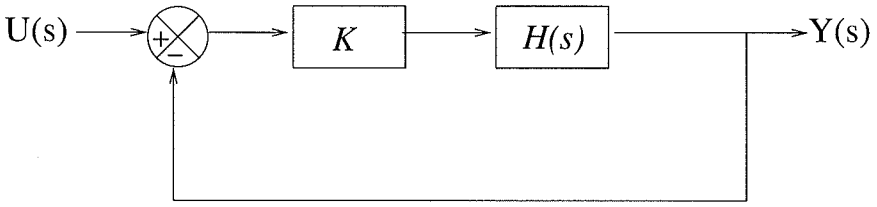
ECE-382: Homework 13

Due April 20, 2007

1. Problems B-8-15, B-8-16, B-8-17, and B-8-19 in textbook. (You can use Matlab for the Nyquist plots.)

2. (This adapts from a past exam question) Consider the feedback system with unity feedback control shown below.



In the figure at the next page, the Nyquist plot of H(s) is shown for $-\infty < \omega < +\infty$, with the arrow denoting increasing ω. In case you need it, the point -1+j0 is shown with a "+" on the plot.

You are given that the number of unstable poles (i.e., poles with nonnegative real part) of $H(s)$ is one.

(a) What is the number of zeros of $H(s)$ with positive real part?

(b) What is the number of unstable poles for the closed-loop system with $k = 0.1$?

(c) What is the number of unstable poles for the closed-loop system with $k = 1$?

(d) What is the number of unstable poles for the closed-loop system with $k = 10$?

(e) Find the range of values of k for the closed-loop system to be stable.

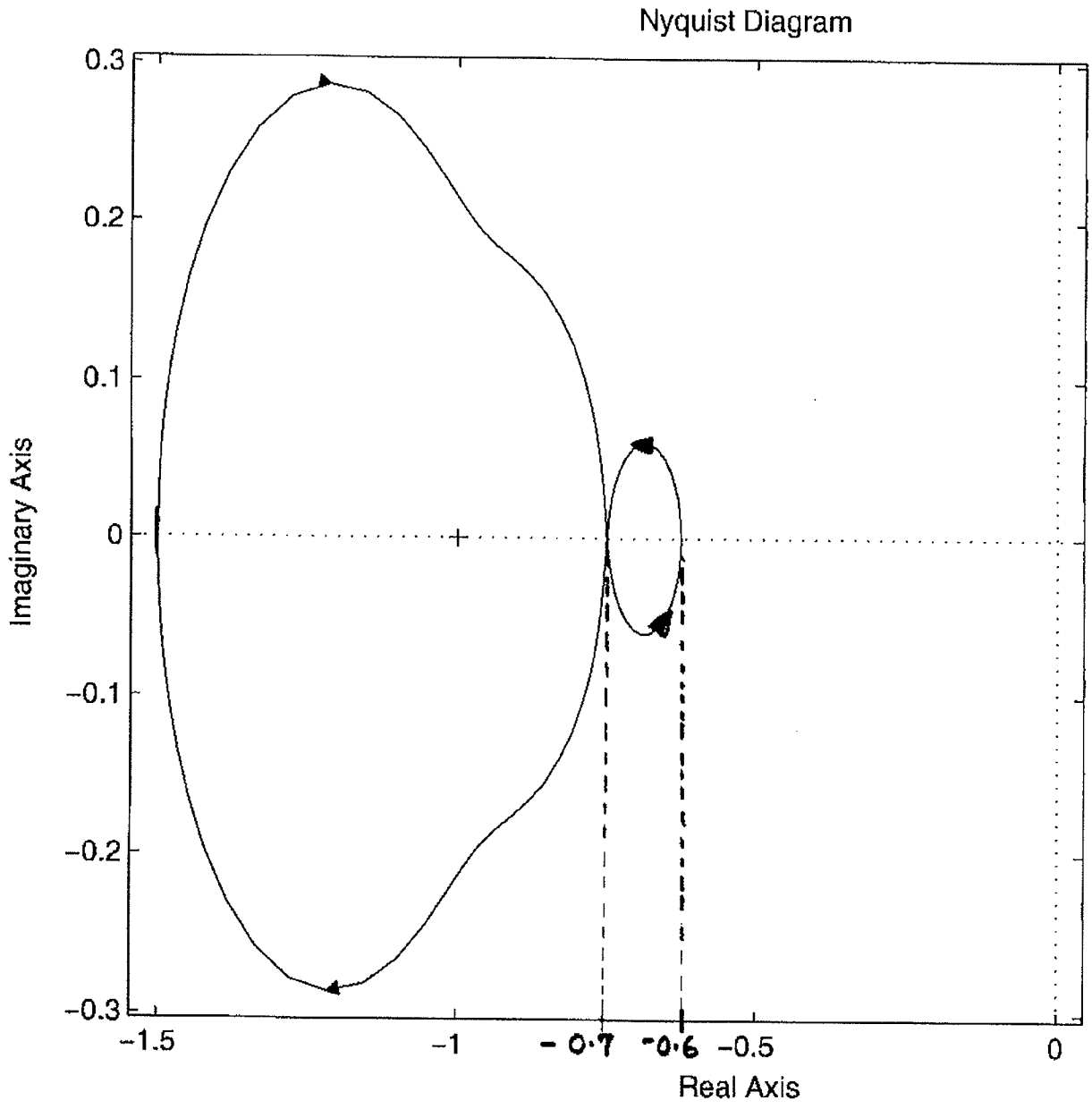


Figure 2: Nyquist plot for problem 2. The real versus imaginary parts of the frequency response $H(j\omega)$ are shown for $-\infty < \omega < \infty$, with the arrows denoting increasing ω as usual. In case you need it, the point $-1 + j0$ is shown with a "+" on the plot.