ECE504 Homework Assignment Number 4
Due by 8:50pm on 04-Nov-2008

Tips: Make sure your reasoning and work are clear to receive full credit for each problem.

1. 5 pts. Chen 5.11 (note that Chen's "marginally stable" is our "stable").

2. 5 pts. Chen 5.12

3. 5 pts. Chen 5.14.

4. 8 pts. Use the **discrete-time** Lyapunov stability theorem to determine if the eigenvalues of

$$\boldsymbol{A} = \begin{bmatrix} 1/2 & 1/2 \\ -1/2 & 1/2 \end{bmatrix}$$

   all have magnitude less than one. Repeat your analysis for

$$\boldsymbol{A} = \begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}.$$

5. 7 pts. Given the homogeneous **discrete-time** system

$$\boldsymbol{x}(k+1) = \begin{bmatrix} \cos(\theta) & \sin(\theta/2) \\ -\sin(\theta/2) & \cos(\theta) \end{bmatrix} \boldsymbol{x}(k)$$

   where θ is a fixed parameter, analytically find all values of $\theta \in [0, 2\pi)$ such that this system is stable. Also, analytically find all values of $\theta \in [0, 2\pi)$ such that this system is asymptotically stable. Hint: You can confirm your analysis with Matlab.