

Homework # 2

Due: September 18, 2006 (Monday)

1. (25%) Problem 3.3 from text
2. (25%) Problem 3.4 from text.
3. (25%) Problem 3.7 from text
4. (25%) Consider a state space system with (A, B, C) given below:

$$A = \begin{bmatrix} -1 & 1 & 0.5 & 0.5 \\ 1 & -1 & 0.5 & 0.5 \\ -1 & 1 & 1 & 2 \\ 1 & -1 & 0 & -1 \end{bmatrix}, \quad B = \begin{bmatrix} 0 & 0 \\ 0 & -1 \\ 1 & 1 \\ 0 & -1 \end{bmatrix}, \quad C = \begin{bmatrix} 1 & -1 & 1 & 2 \\ -1 & -1 & 1 & 1 \end{bmatrix}.$$

Find the Kalman decomposition for this system and the transformation matrix. Please attach the MATLAB code that can transform any given (A, B, C) to the Kalman decomposition representation.

5. (25% Bonus) Prove all the equivalent statements on controllability and observability (p.8 and p.13 of lecture 3).