Homework 5, Linear Systems, Fall 2007

- When turn in your homework, please write down: 作業次別, 姓名, 學號, 系級, 日期
- Assigned: 12/18/07, Due on 12/25/07

- (Minimal Realization)

3 (A parallel electrical circuit) — 20 points

- If $L_1 = L_2, C_1 = C_2, R_1 = R_2$, and $c = [0, 0, 0, 1]$, show that the state-space model is NOT a minimal realization and find a minimal realization from the state-space model. You also need to show that the realization you find is minimal.

5 (A 3-tank system) — 20 points

- If the three-tank system is with only input u_2 and output x_2, then $\mathbf{A}, \mathbf{B}, \mathbf{C}, \mathbf{D}$ of the state-space model is given in the following.

$$\mathbf{A} = \begin{bmatrix} -3 & 3 & 0 \\ 2 & -4 & 2 \\ 0 & 3 & -3 \end{bmatrix}, \mathbf{B} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, \quad \mathbf{C} = [\,0 \quad 1 \quad 0\,], \quad \mathbf{D} = [\,0\,],$$

Show that the state-space model is NOT a minimal realization and find a minimal realization from the state-space model. You also need to show that the realization you drive is minimal.