

Answers to ES205 Exam 1, 2002

**Problem 1**

1.1)  $R_1 R_2 C^2 \ddot{v}_o + (2R_1 + R_2) \dot{v}_o + v_o = R_1 R_2 C^2 \ddot{v}_i + 2R_1 C \dot{v}_i + v_i$

1.2)

a) a/b

b) 1/b

c)  $\frac{a}{b} \dot{x} + x = \frac{1}{b} y$

1.3)

$$\begin{Bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{Bmatrix} = \begin{bmatrix} 0 & 1 \\ -4 & -4 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} \{u\}$$

1.4)

a) 4 rad/s

b) 0.4

c) 3.67 rad/s

d) 10

1.5) b

1.6) 0.6

1.7) Not available

**Problem 2**

$$\frac{V_o}{V_s} = \frac{R_1 + R_2}{R_1 R_2^2 C_1 C_2 s^2 + (R_2^2 C_2 - R_1^2 C_1 + R_1 R_2 C_2) s + R_2}$$

$$\omega_n = \frac{1}{\sqrt{R_1 R_2 C_1 C_2}}$$

**Problem 3**

I had nine equations and nine unknowns.