II.1 **a)**

System1   System2

$$A_1 \frac{dh}{dt} = F_1 - F_2 \quad \text{tank I}$$

$$A_2 \frac{dh}{dt} = F_2 - F_3 \quad \text{tan 2.}$$

But $F_2 = \alpha_1 h_1$, $F_3 = \alpha_2 h_2$

$$A_1 \frac{dh_1}{dt} + \alpha_1 h_1 = F_1$$

$$A_2 \frac{dh_2}{dt} + \alpha_2 h_2 - \alpha_1 h_1 = 0$$

$$A_1 \frac{dh}{dt} = F_1 - F_2 \quad \text{Tank I}$$

$$A_2 \frac{dh_2}{dt} = F_2 - F_3 \quad \text{tan 2.}$$

But $F_2 = \alpha(h_1 - h_2)$, $F_3 = \alpha_2 h_2$

$$A_1 \frac{dh_1}{dt} + \alpha_1 h_1 - \alpha_1 h_2 = f_1$$

$$A_2 \frac{dh_2}{dt} + (\alpha_1 + \alpha_2) h_2 - \alpha h_1 = 0$$

b) State Variable: h_1, h_2 State variable: h_1, h_2

c) The mathematical model for sys I is easier to solve because the 2 differential equation can be solved individually in sequency (first tank, then tan 2). This is not true for system II where the 2 differential eqn's must be solved simultaneously.

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