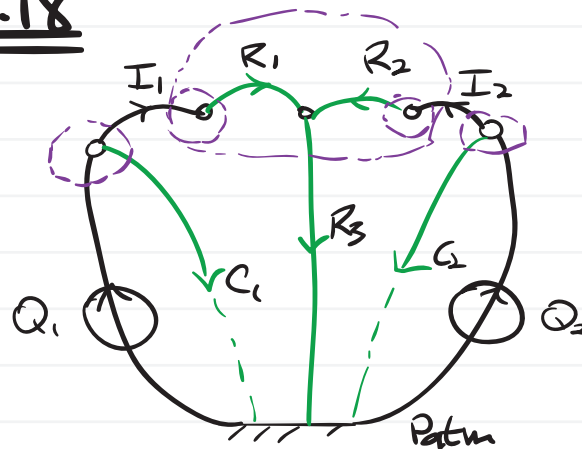


Example: SO 5.18

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1. Linear graph
+ normal tree2. State vars: $P_{C1}, P_{C2}, Q_{I1}, Q_{I2}$ System order: $n=4$

3. Elemental eq's:

C_1	$\frac{dP_{C1}}{dt} = \frac{1}{C_1} Q_{C1}$
C_2	$\frac{dP_{C2}}{dt} = \frac{1}{C_2} Q_{C2}$
I_1	$\frac{dQ_{I1}}{dt} = \frac{1}{I_1} P_{I1}$
I_2	$\frac{dQ_{I2}}{dt} = \frac{1}{I_2} P_{I2}$
R_1	$P_{R1} = R_1 Q_{R1}$
R_2	$P_{R2} = R_2 Q_{R2}$
R_3	$P_{R3} = R_3 Q_{R3}$

4. Continuity

$$Q_{C1} = Q_1 - Q_{I1}$$

$$Q_{R1} = Q_{I1}$$

$$Q_{R2} = Q_{I2}$$

$$Q_{C2} = Q_2 - Q_{I2}$$

$$Q_{R3} = Q_{I1} + Q_{I2}$$

$$\vec{x} = \begin{bmatrix} P_{C1} \\ P_{C2} \\ Q_{I1} \\ Q_{I2} \end{bmatrix}$$

5. Compatibility

$$P_{I1} = -P_{R1} - P_{R3} + P_{C1}$$

$$P_{I2} = -P_{R2} - P_{R3} + P_{C2}$$

6. Algebra (state equations).

C_1	$\frac{dP_{C1}}{dt} = \frac{1}{C_1} Q_{C1} = \frac{1}{C_1} (Q_1 - Q_{I1})$ ✓
C_2	$\frac{dP_{C2}}{dt} = \frac{1}{C_2} Q_{C2} = \frac{1}{C_2} (Q_2 - Q_{I2})$ ✓
I_1	$\frac{dQ_{I1}}{dt} = \frac{1}{I_1} P_{I1} = \frac{1}{I_1} (-P_{R1} - P_{R3} + P_{C1}) = \frac{1}{I_1} (-R_1 Q_{I1} - R_3 (Q_{I1} + Q_{I2}) + P_{C1})$ ✓
I_2	$\frac{dQ_{I2}}{dt} = \frac{1}{I_2} P_{I2} = \frac{1}{I_2} (-P_{R2} - P_{R3} + P_{C2}) = \frac{1}{I_2} (-R_2 Q_{I2} - R_3 (Q_{I1} + Q_{I2}) + P_{C2})$ ✓

7. Output equation. $y = \begin{bmatrix} 0 & 0 & 1 & 1 \end{bmatrix} \vec{x} + \begin{bmatrix} 0 & 0 \end{bmatrix} \vec{u}$