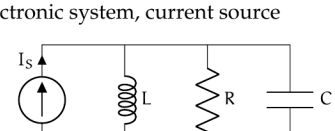


**ss.exe Exercises for Chapter ss**

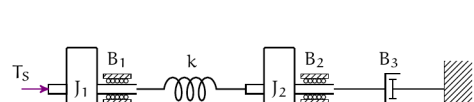
**Exercise ss.7**

Draw necessary sign coordinate arrows, a linear graph, a normal tree, and identify state variables and system order for each of the following schematics.

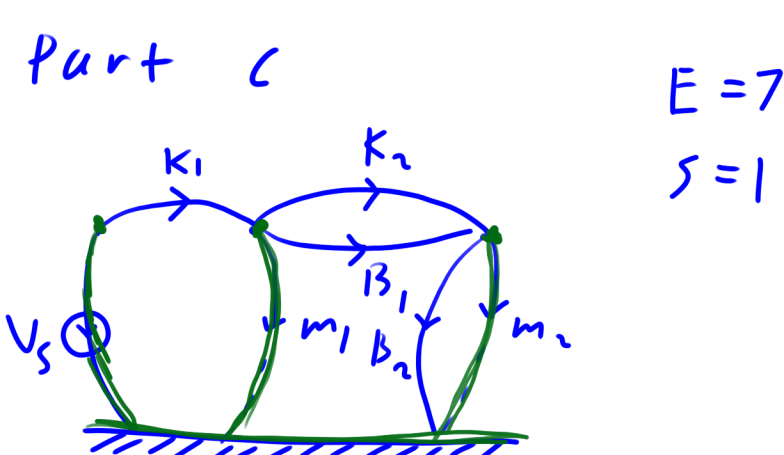
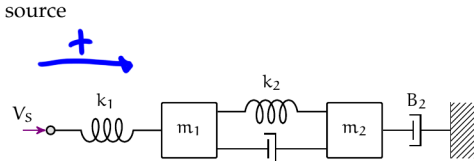
a. electronic system, current source



b. rotational mechanical system, torque source



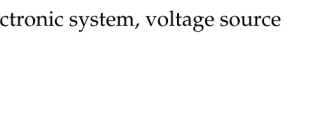
c. translational mechanical system, velocity source



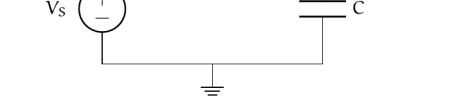
**Exercise ss.8**

Draw necessary sign coordinate arrows, a linear graph, a normal tree, and identify state variables and system order for each of the following schematics.

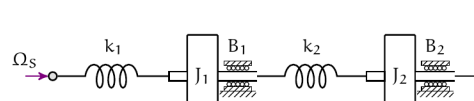
a. electronic system, voltage source



b. rotational mechanical system, angular velocity source



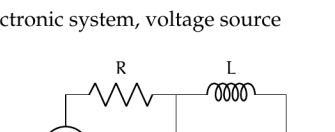
c. translational mechanical system, force source



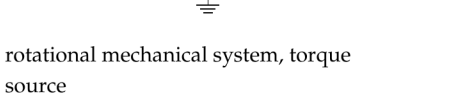
**Exercise ss.9**

Draw necessary sign coordinate arrows, a linear graph, a normal tree, and identify state variables and system order for each of the following schematics.

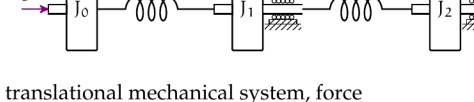
a. electronic system, voltage source



b. rotational mechanical system, torque source

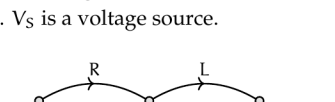


c. translational mechanical system, force source



**Exercise ss.10**

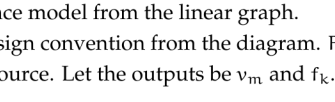
Use the following linear graph for a circuit to answer the questions below, which are the steps to determining a state-space model of the circuit. Use the sign convention from the diagram.  $V_s$  is a voltage source.



- Determine the normal tree, state variables, system order, state vector, input vector, and output vector for the outputs  $i_R$  and  $v_C$ .
- Write the required elemental, continuity, and compatibility equations.
- Solve for the state equation in standard form.
- Solve for the output equation in standard form.

**Exercise ss.11**

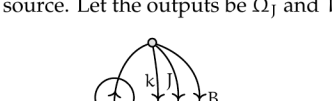
Use the following linear graph for a mechanical translational system to answer the questions below, which are the steps to determining a state-space model from the linear graph. Use the sign convention from the diagram.  $F_s$  is a force source. Let the outputs be  $v_m$  and  $f_k$ .



- Determine the normal tree, state variables, system order, state vector, input vector, and output vector.
- Write the required elemental, continuity, and compatibility equations.
- Solve for the state equation in standard form.
- Solve for the output equation in standard form.

**Exercise ss.12a) and b)**

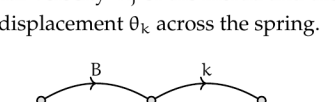
Use the following linear graph for a mechanical rotational system to answer the questions below, which are the steps to determining a state-space model from the linear graph. Use the sign convention from the diagram.  $T_s$  is a torque source. Let the outputs be  $\Omega_1$  and  $T_B$ .



- Determine the normal tree, state variables, system order, state vector, input vector, and output vector.
- Write the required elemental, continuity, and compatibility equations.
- Solve for the state equation in standard form.
- Solve for the output equation in standard form.

**Exercise ss.12c) and d)**

Use the following linear graph for a mechanical rotational system to answer the questions below, which are the steps to determining a state-space model from the linear graph. Use the sign convention from the diagram.  $\Omega_s$  is an angular velocity source. Let the outputs be the angular velocity  $\Omega_1$  of the inertia and the angular displacement  $\theta_s$  across the spring.

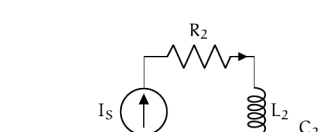


- Determine the normal tree, state variables, system order, state vector, input vector, and output vector.
- Write the required elemental, continuity, and compatibility equations.
- Solve for the state equation in standard form.
- Solve for the output equation in standard form.

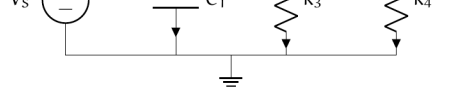
**Exercise ss.13a) and b)**

Use the assigned coordinate arrows to draw a linear graph, a normal tree, and identify state variables and system order for each of the following schematics.

1. electronic system, voltage and current source



2. rotational mechanical system, torque source, coordinate arrow



3. translational mechanical system, force sources (2)

