02.4 graphs.sysmod Systematic linear graph modeling

1 A **system graph** is a representation of a physical system as a set of interconnected linear graph elements. The construction of a system graph requires a number of engineering decisions. In general, we can use the following procedure.

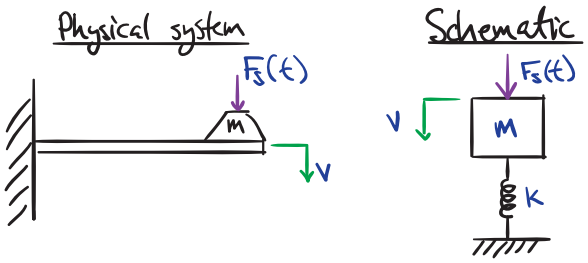
1. Define the system boundary and analyze the physical system to determine the essential features that must be included in the model, especially:
   a) inputs,
   b) outputs,
   c) energy domains, and
   d) key elements.
2. Form a schematic model of the physical system and assign schematic signs according to the sign convention of Lecture 02.2 graphs.sign.
3. Determine the necessary lumped-parameter elements representing the system's
   a) energy sources,
   b) energy storage, and
   c) energy dissipation.
4. Identify the across-variables that define the linear graph nodes and draw a set of nodes.
5. Determine appropriate nodes for each lumped element and include each element in the graph.
6. Assign linear graph signs according to the sign convention of Lecture 02.2 graphs.sign.

2 The first three of these steps are the hardest. Considerable physical insight is required to construct an effective model. Often it is helpful—if not necessary—to have experimental results to guide the process.

Example 02.4 graphs.sysmod-1

re: linear graph model of translational mechanical system

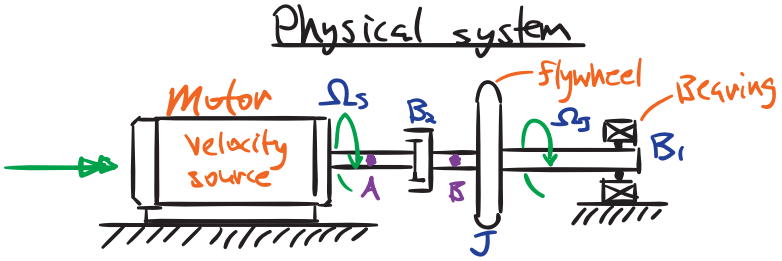
For the system shown, develop a linear graph model.



Example 02.4 graphs.sysmod-2

re: linear graph model of rotational mechanical system

For the system shown, develop a linear graph model.



Example 02.4 graphs.sysmod-3

re: linear graph model of electronic system

For the system shown, develop a linear graph model.