

Bond Graphs practice

A graphical language for the analysis of multiphysical systems



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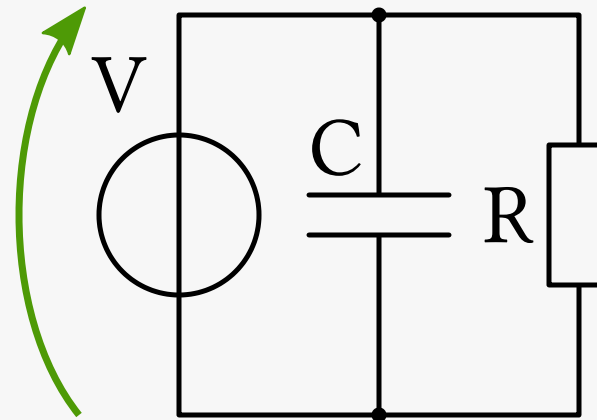
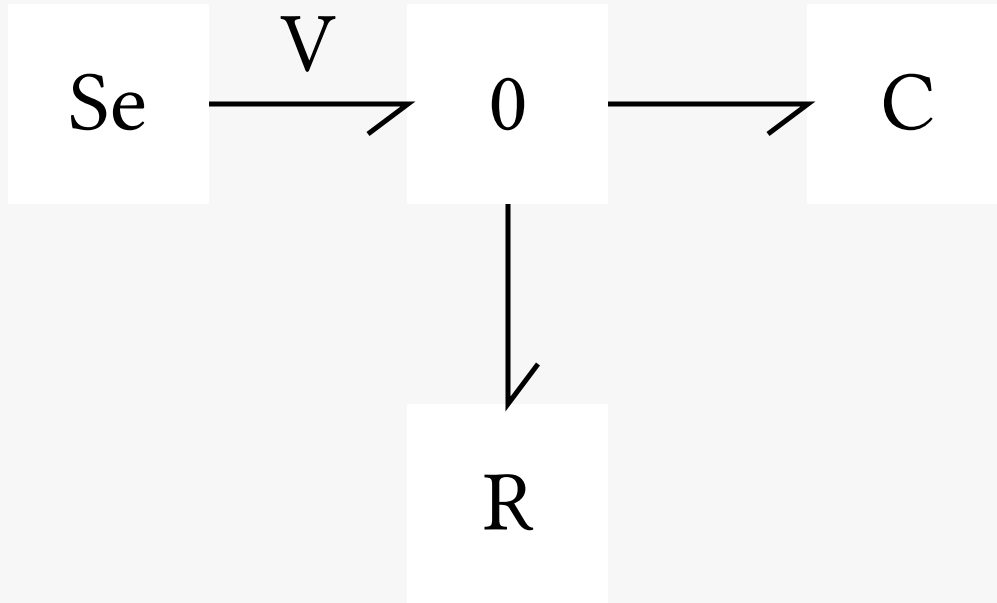
SG6: Dec. 2021 – Jan. 2022

Slide deck 4: causality practice

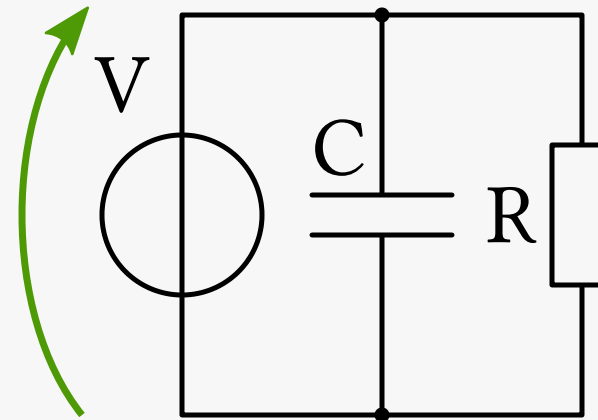
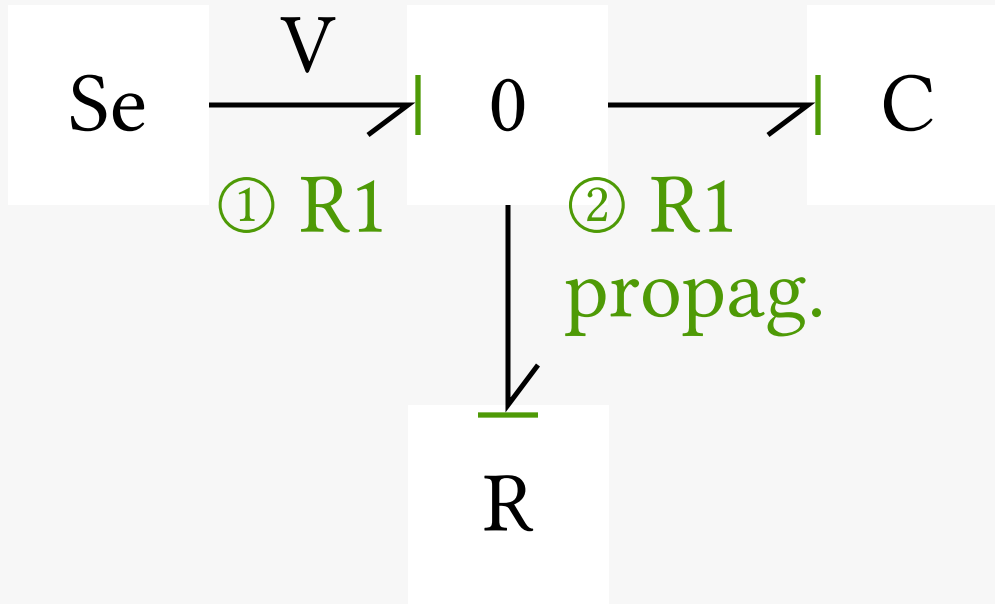
Course outline

- Bond graph objectives
- The bond graph language
 - Bonds and power variables: the physical analogy
 - Elements
- Practice: reading & creating bond graphs
- Causality and derivation of mathematical models
 - Principles
 - **Practice**

Causality assignment Ex1

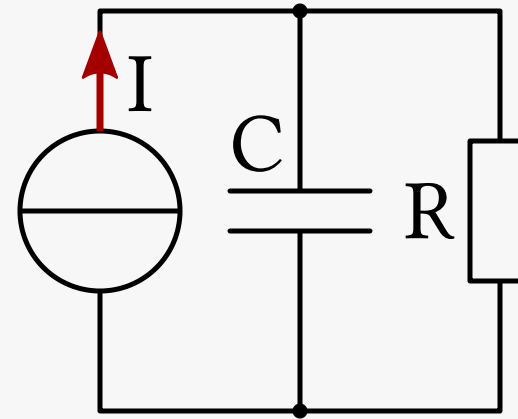
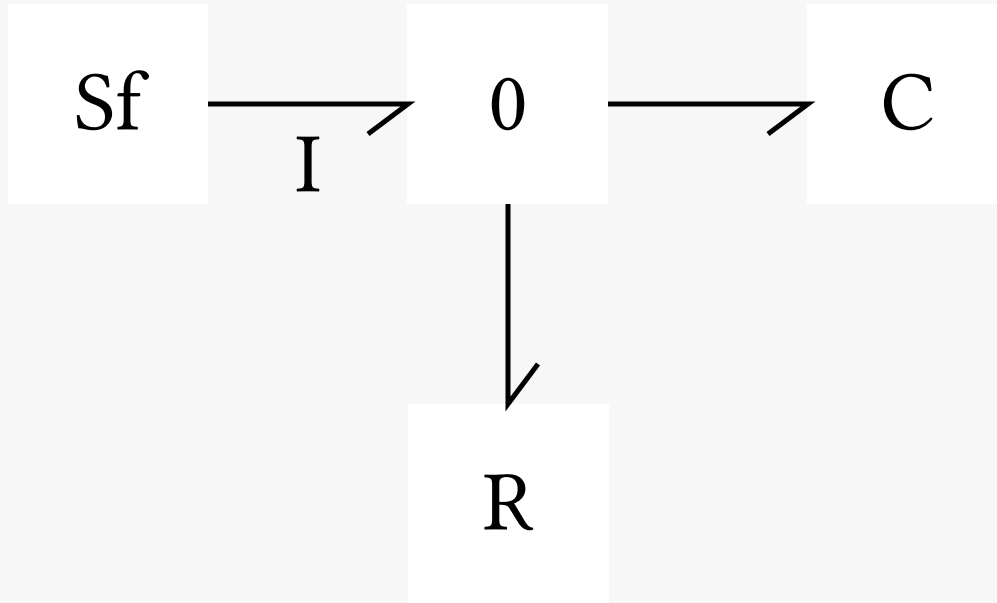


Causality assignment Ex1 (Sol.)

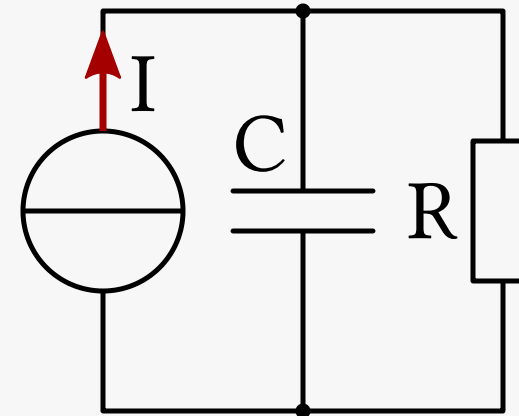
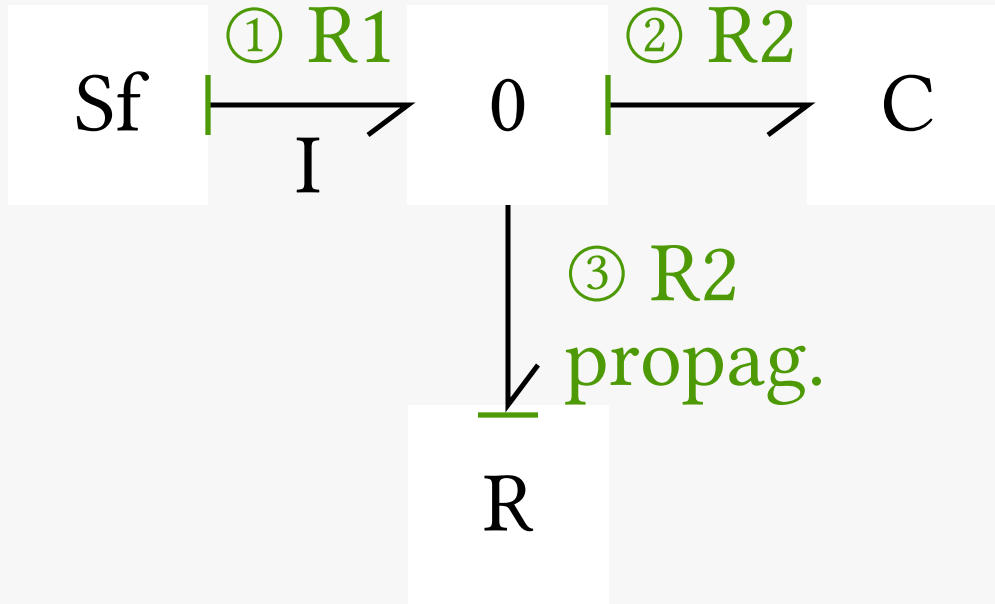


1. $R1$: Se sets the effort on the 0 junction
2. Propagation: effort propagates through the 0 junction

Causality assignment Ex2



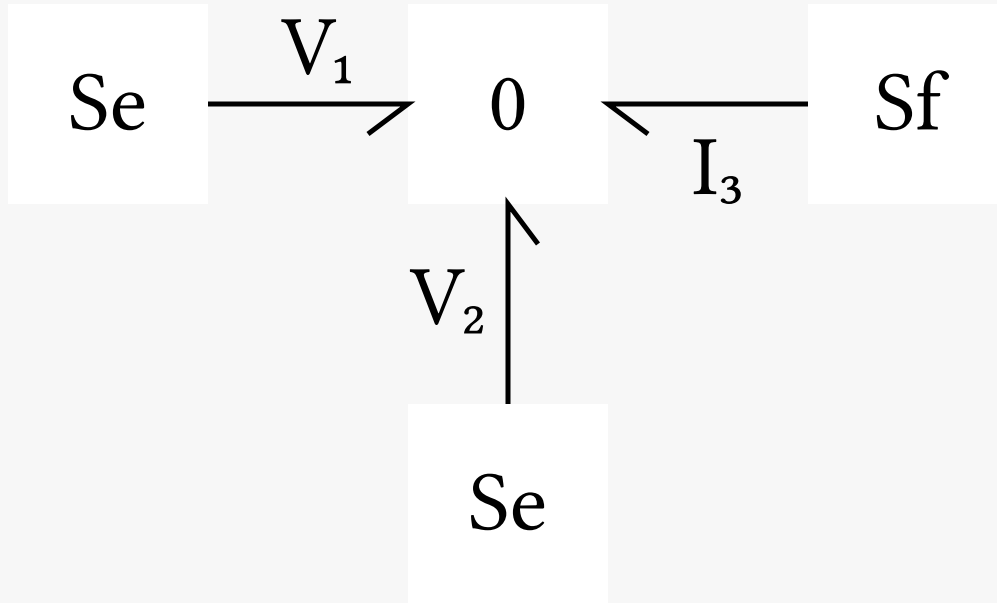
Causality assignment Ex2 (Sol.)



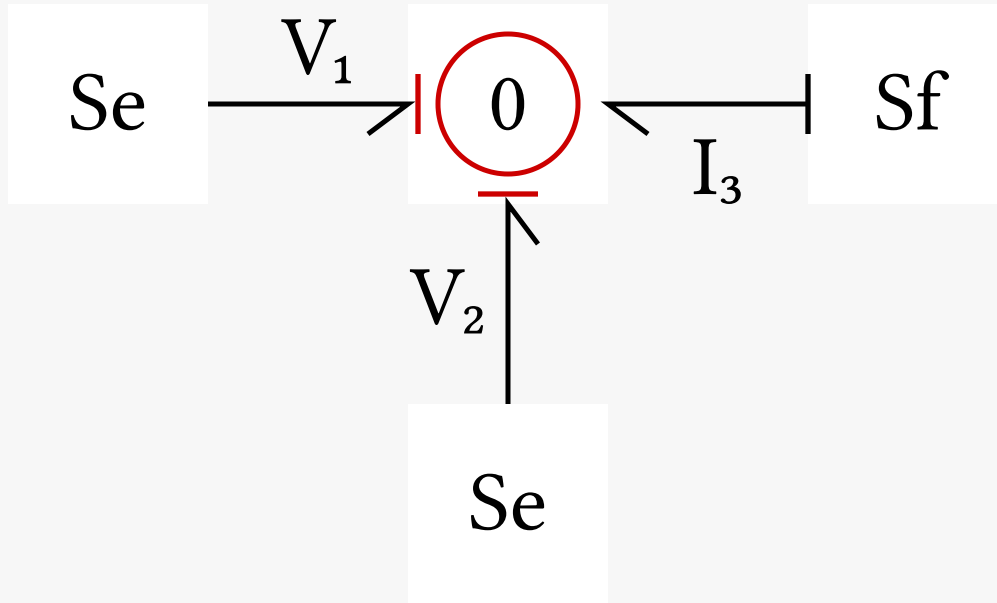
1. $R1$: Sf sets the flow on the 0 junction.
 - (no propagation)
2. $R2$: Set integral causality for C
 - $\rightarrow C$ sets the effort on the 0 junction

3. Propagation of effort to R through the 0 junction

Impossible connections exercise



Impossible connections exercise (Sol.)



The physical impossibility of parallel voltage sources emerges as a **causality conflict** on the 0 junction (“only one incoming effort allowed”).