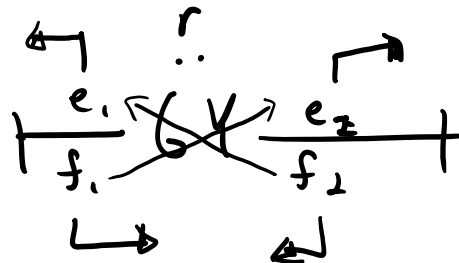
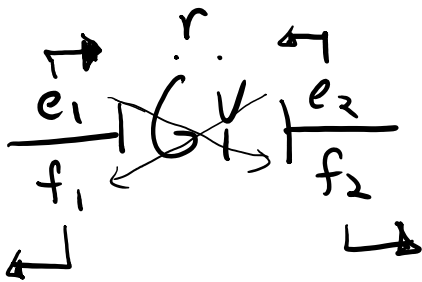


- HW solutions visible in Canvas files
- HW 4 Due Monday
- Midterms week from Monday (Oct 28)
- Lab solutions will be posted 1 week after due date

Causality of 2-Ports

Gyrator



$$\begin{aligned} \boxed{f_1} &= \frac{1}{r} \boxed{e_2} \\ \boxed{f_2} &= \frac{1}{r} \boxed{e_1} \end{aligned}$$

↑ ↓
Outputs Inputs

$$\begin{aligned} \boxed{e_1} &= r \boxed{f_2} \\ \boxed{e_2} &= r \boxed{f_1} \end{aligned}$$

↓ ↑
Outputs Input

Transformer

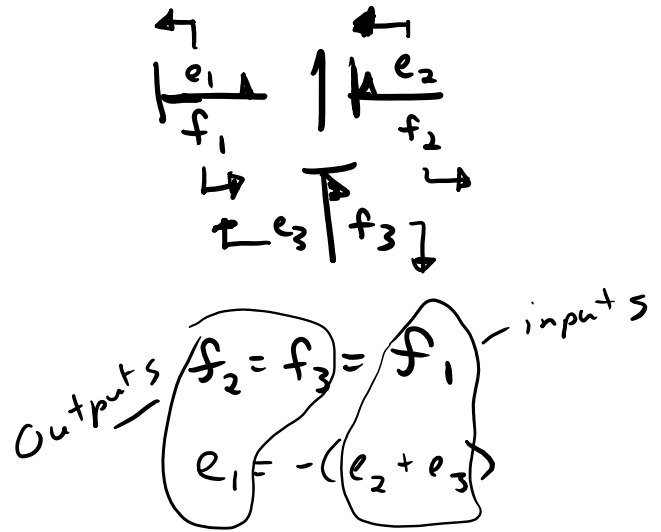
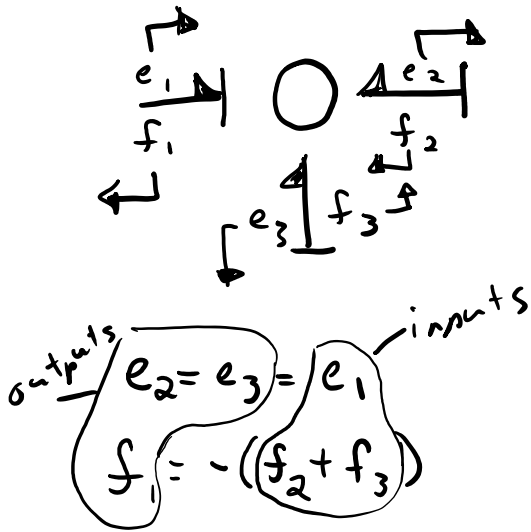
- I T F -

| T F |

Causality of 3 (or greater) Ports

key thing → only one bond can be the input for that type of e or f
common effort

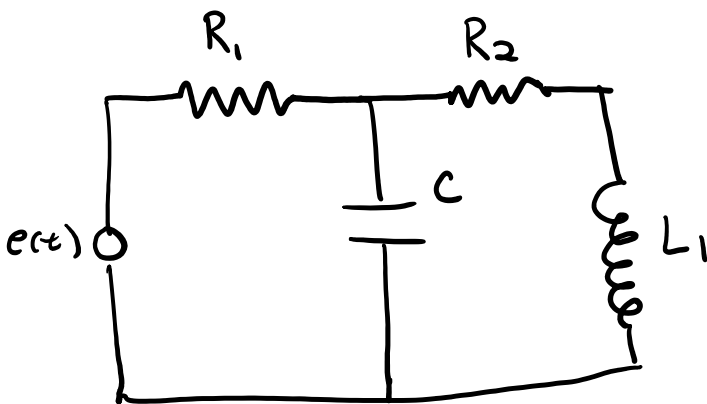
Common flow



$$f_1 + f_2 + f_3 = 0$$

Chapter 4: System Models

Electrical Networks



R_1, R_2 : linear resistors

L : linear inductor

C : linear capacitor

$e(t)$: voltage source

4 step process to making a bond graph of an electrical network.

Step 1: assign a power convention

Step 2: add \emptyset junctions for each electrical node/junction that has a common voltage

Step 3: establish voltage drops across components with 1 junctions

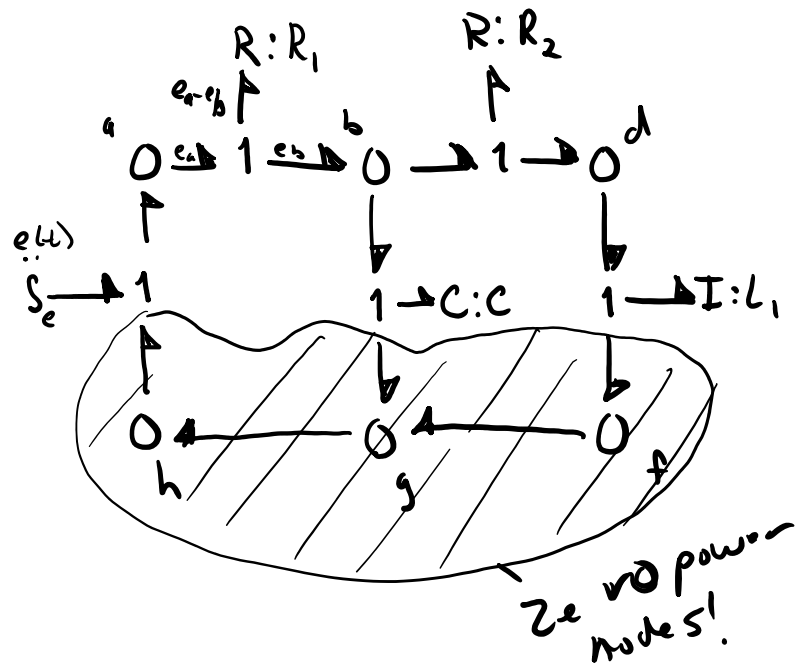
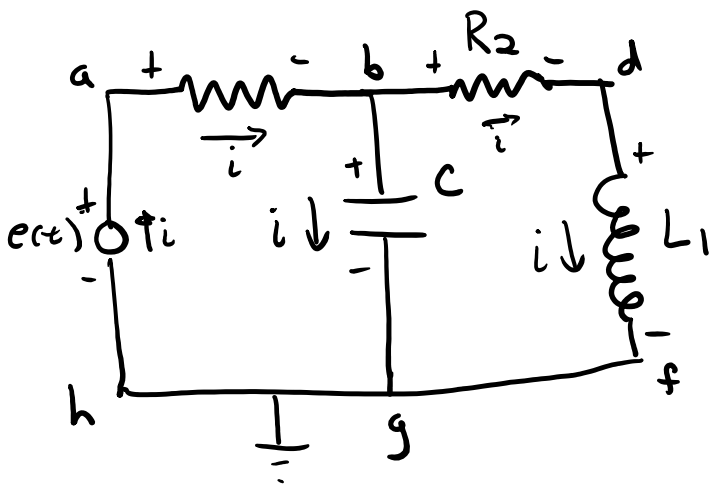
Step 4: choose a ground or reference voltage and remove these zero power nodes

Step 5: (optional) simplify the graph

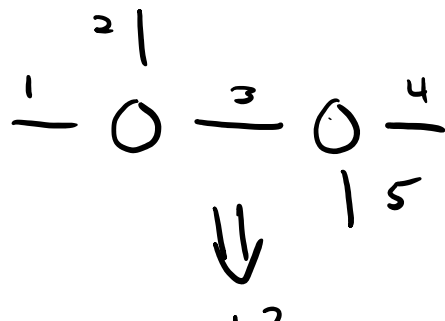
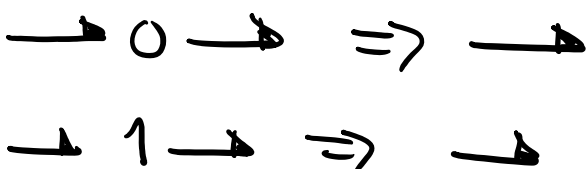
The \emptyset and 1 junctions will enforce Kirchoff's Laws:

- Kirchoff's Voltage Law: voltage around a loop must be zero

- Kirchoff's Current Law: sum of currents at a junction must be zero



Simplify the graph



$\rightarrow 1 \rightarrow \Rightarrow \rightarrow$

\Downarrow
1²
1 0 4
1 5

