



Lumped-Element Modeling

- ☑ Last lecture
 - One-port elements
 - Generalized Capacitor
 - Generalized Inertance
 - Kirchhoff's Laws
 - Example

- Today:
 - Single-port element examples
 - Two-port elements
 - Transformer
 - Gyrator

📖 Reading: Senturia, pp. 110-123.

■ Ideal One-Port Elements:

↗ There are 5 one-port elements

– 2 ideal sources: effort and flow (i.e. voltage, current, motors, etc.)

– dissipator: dissipates energy,

$$e = R \cdot f$$

– compliance: stores P.E. due to displacement,

$$e = \frac{1}{j\omega C} \cdot f$$

– inertance: stores K.E. due to momentum,

$$e = j\omega I \cdot f$$

■ Question:

Given the variable distribution of the physical phenomena, how do we generate the lumped-element?

- Solve the “static” PDE (i.e. Poisson’s/Laplace’s Equation)
 - analytical, FDE, FEM, etc.
- Set a reference displacement spatial location
- Compute the incremental P.E. and K.E.
- Set the integrated distributed and lumped energies equal to solve for the storage elements