Module 1: How to model
- Tomography
- Page Rank
- Imaging

Module 2: Get into one model:

Creativity / Design

Sensor → Computer Process → Actuator

Module 2

This module: Circuit Analysis

Notation / Conventions
**Electrical Quantities**

1. **Voltage**
   - Units: Volts (V)
   - Symbol: V
   - "Across"

2. **Current**
   - Units: Amperes (A)
   - Symbol: I

3. **Resistance**
   - Units: Ohm (Ω)
   - Symbol: R

**Circuit Diagrams**

**Equations: Linear**

\[ \text{Vel} = \text{Vel}_{\text{element}} \]

**Circuit Elements**

1. **Wire**
   - Voltage: across
   - Current: through
   - \[ \text{Current (I)} \]
   - \[ \text{Voltage (V)} \]
   - \[ \text{Vel} = 0 \]
   - \[ I_d = \text{arbitrary} \]
1. **Resistor**
\[ R \quad I_{el} \quad V_{el} \]

- **Ohm's Law**
\[ V_{el} = R \cdot I_{el} \]

2. **Open Circuit**
\[ I_{el} + V_{el} \]

3. **Voltage Source**
- Maintains a potential difference across its terminals

- Voltage

\[ V \]

- Current

\[ I \]
\[ \text{Vel} = \text{Vs} \]
\[ I_{el} = \text{anything} \]

- Current Source

- Ground Node

Mt. Rainer: 4000 m

Define voltage as 0. Measure voltage with respect to this point.
How to draw circuits

"Generic" circuit element
+   Vel   -
    Iel

"Passive Sign Convention"

Current goes in to the + sign of the voltage and out of the negative sign.

Nodes, Branches
Branches: Connections between nodes.

- The unreasonable effectiveness of mathematics.
- KIRCHHOFF's Laws.

**KCL**: The sum of all currents entering a node equals the sum of all currents exiting a node.

\[ I_1 + I_3 = I_2 \]

\[ I_1 + I_3 - I_2 = 0 \]
KVL: The sum of the voltages across the elements of a connected loop must be zero.

\[-V_A + V_B + V_C = 0\]

6.021 Quantitative Physiology