Calculating the Resistance of a Wire

**Uniform cross section**

- Length of wire: \( L \)
- Area of cross section: \( A \)
- Resistivity of material: \( \rho \)
- Current density: \( J = \frac{E}{\rho} \) [A/m²]
- Current: \( I = JA \) [A]
- Voltage: \( V = EL \) [V]
- Resistance: \( R \equiv \frac{V}{I} = \frac{\rho L}{A} \) [Ω]

**Variable cross section**

- Cross-sectional profile: \( A(x) \)
- Resistance of slice: \( dR = \frac{\rho dx}{A(x)} \)
- Resistance of wire: \( R = \rho \int_0^L \frac{dx}{A(x)} \)