Calculating the Resistance of a Wire

Uniform cross section

- Length of wire: L
- Area of cross section: A
- Resistivity of material: ρ
- Current density: $J = \dfrac{E}{\rho} \quad [\mathrm{A/m^2}]$
- Current: $I = JA \quad [\mathrm{A}]$
- Voltage: $V = EL \quad [\mathrm{V}]$
- Resistance: $R \equiv \dfrac{V}{I} = \dfrac{\rho L}{A} \quad [\Omega]$

Variable cross section

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