

## DC Current

### Current Density

$$I = \int \mathbf{J} \cdot \mathbf{e}_n dS$$

### Conservation Equation

$$\Delta \cdot \mathbf{J} + \frac{\partial \rho}{\partial t} = 0$$

$$\oint \mathbf{J} \cdot \mathbf{e}_n dS = -\frac{dQ}{dt}$$

### Conductivity

$$\mathbf{J} = \sigma \mathbf{E}$$

### Effect

$$P = \int \mathbf{J} \cdot \mathbf{E} dv$$

### Boundary Conditions

$$\begin{cases} \mathbf{e}_{n2} \cdot (\mathbf{J}_1 - \mathbf{J}_2) = 0 & \text{(no surface current)} \\ \mathbf{E}_{t1} = \mathbf{E}_{t2} \end{cases}$$

### Time Constant

$$RC = \frac{\epsilon_r \epsilon_0}{\sigma}$$

### Analogy Elektrostatics - DC Current

$\mathbf{E}, V$	$\mathbf{E}, V$
$\mathbf{D}$	$\mathbf{J}$
$\epsilon_r \epsilon_0$	$\sigma$
$Q$	$I$
$C$	$G$