Summary from previous lecture

- Laplace transform

$$\mathcal{L}\left[f(t)\right] \equiv F(s) = \int_{0-}^{+\infty} f(t)\mathrm{e}^{-st}\,\mathrm{d}t.$$

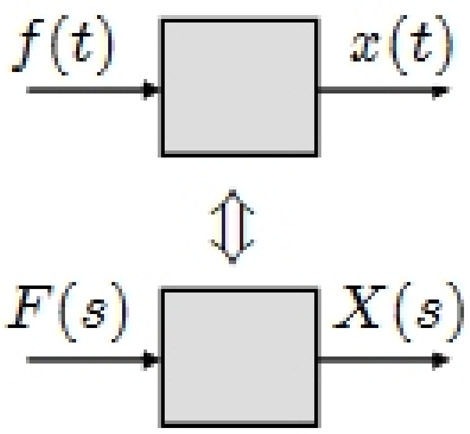
$$\mathcal{L}\left[u(t)\right] \equiv U(s) = \frac{1}{s}.$$

$$\mathcal{L}\left[\mathrm{e}^{-\alpha t}\right] = \frac{1}{s+\alpha}.$$

$$\mathcal{L}\left[\dot{f}(t)\right] = sF(s) - f(0-).$$

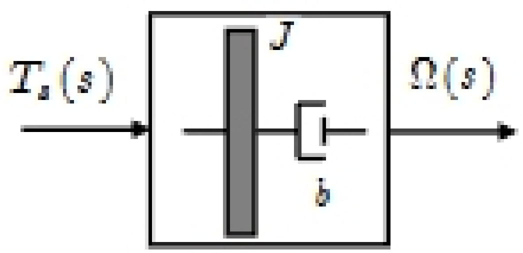
$$\mathcal{L}\left[\int_{0-}^{t} f(\xi)\,\mathrm{d}\xi\right] = \frac{F(s)}{s}.$$

- Transfer functions and impedances



$$\mathrm{TF}(s) = \frac{X(s)}{F(s)}$$

$$Z(s) = \frac{F(s)}{X(s)}$$



$$\mathrm{TF}(s) := \frac{\Omega(s)}{T_s(s)} = \frac{1}{Js+b}.$$

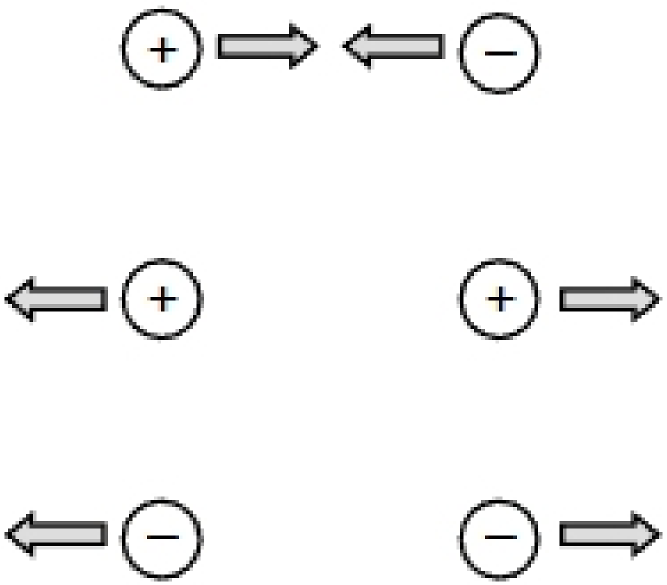
$$Z_J = Js; \quad Z_b = b; \quad \mathrm{TF}(s) = \frac{1}{Z_J + Z_b}$$

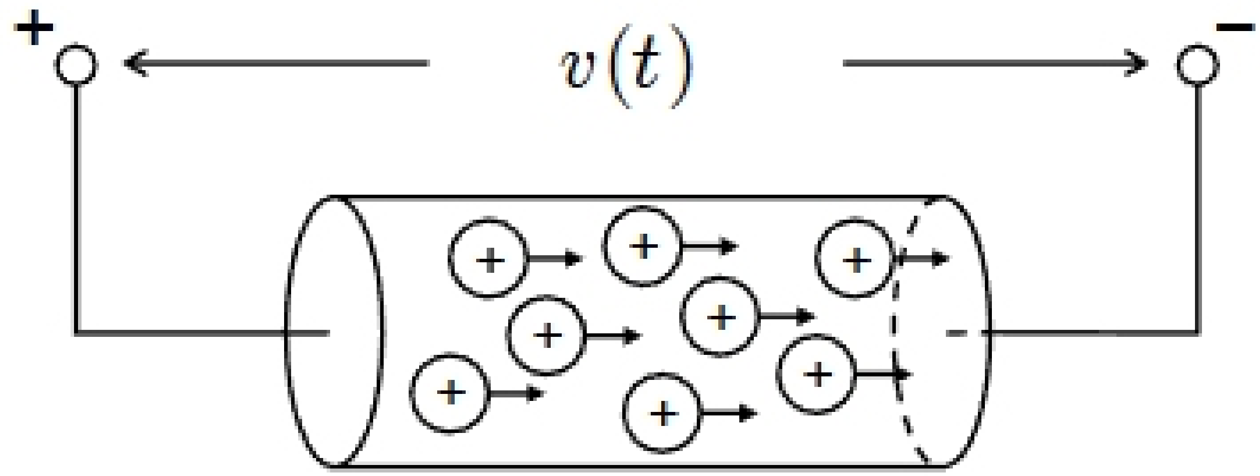
Goals for today

- Dynamical variables in electrical systems:
  - charge,
  - current,
  - voltage.
- Electrical elements:
  - resistors,
  - capacitors,
  - inductors,
  - amplifiers.
- Transfer Functions of electrical systems (networks)
- **Next lecture (Friday):**
  - DC motor (electro-mechanical element) model
  - DC motor Transfer Function

Electrical dynamical variables: charge, current, voltage

charge q	Coulomb [Cb]
charge flow $\equiv$ current $i(t)$	Ampére [A]=[Cb]/[sec]
voltage (*aka* potential) $v(t)$	Volt [V]





$$i(t) := \frac{\mathrm{d}q(t)}{\mathrm{d}t}$$