GBIO-0029

Introduction to basics electronics principles

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Communication Outline

Section 1

Basics principles

Impedance

Ohms law :

$$U = R.I \quad (1)$$

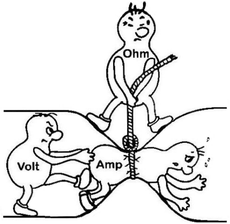


Figure: Ohms law

Impedance

Electrical impedance is the measure of the opposition that a circuit presents to a current when a voltage is applied.

It extends the concept of resistance to *AC* circuit.

$$Z(\omega) = \frac{U(\omega)}{I(\omega)} \quad (2)$$

Passive components

Component	Impedance	if frequency $\nearrow$ impedance :
Resistor	R	$\rightarrow$
Capacitor	$\frac{1}{j\omega C}$	$\searrow$
Inductor	$j\omega L$	$\nearrow$

Kirchhoff law

nodes law

The sum of currents flowing into a node is equal to the sum of currents flowing out of that node

voltage law

The directed sum of the electrical potential differences (voltage) around any closed network is zero

usefull examples

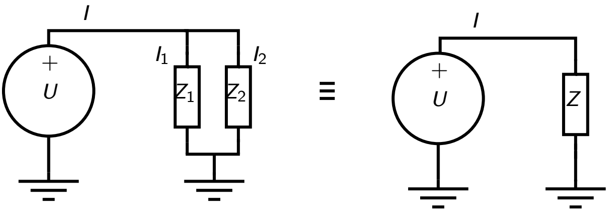


Figure: Parallel impedance

$$U = Z_1.I_1 = Z_2.I_2 = Z * I$$
$$I_2 = \frac{Z_1}{Z_2} I_1 \qquad (3)$$

$$I = I_1 + I_2$$
$$I = I_1 + \frac{Z_1}{Z_2} I_1 = I_1.\frac{Z_2 + Z_1}{Z_2} \qquad (4)$$

$$Z * I_1.\frac{Z_2 + Z_1}{Z_2} = Z_1.I_1$$
$$Z = \frac{Z_2.Z_1}{Z_1 + Z_2} \qquad (5)$$

usefull examples

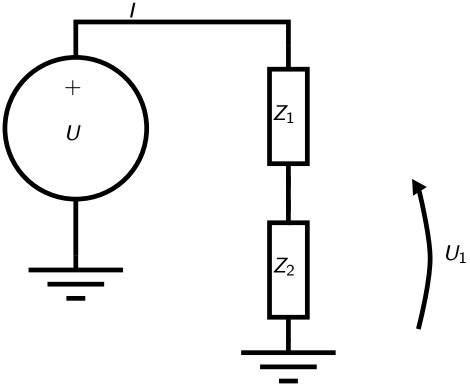


Figure: potentiometric divider

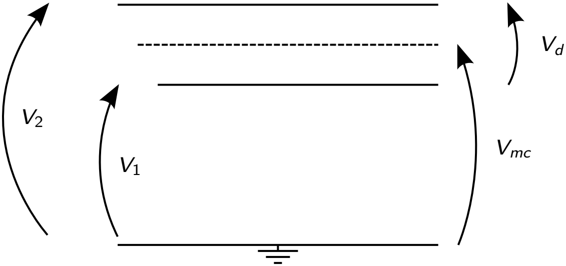
$$U = (Z_1 + Z_2).I$$
$$I = \frac{U}{Z_1 + Z_2} \quad (6)$$

$$U_1 = Z_2.I$$
$$U_1 = U.\frac{Z_2}{Z_1 + Z_2} \quad (7)$$

Section 2

Common Mode

Common and differential mode voltage

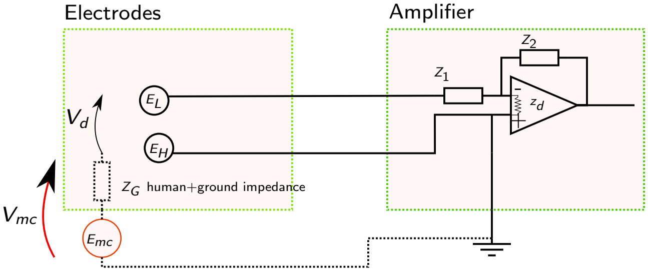


$$V_{mc} = \frac{V_1 + V_2}{2}$$

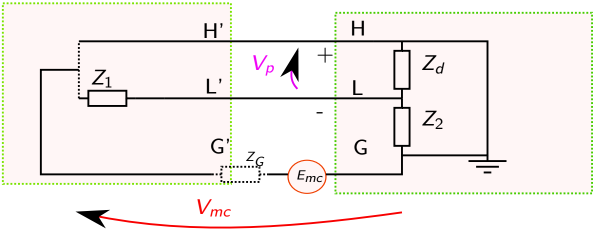
$$V_d = V_2 - V_1$$

Figure: Common mode voltage

Example : Electrodes to inverter amplifier



Common mode equivalent circuit



$V_p = -\frac{Z_2}{Z_1+Z_2} * V_{mc}$ = no rejection of common mode parasites