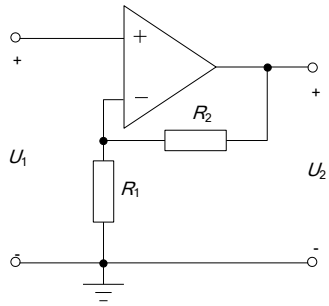
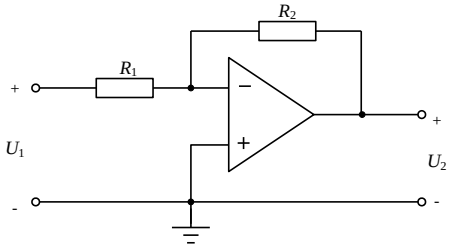
Formelsamling Elektriska kretsar LEU470, 2015

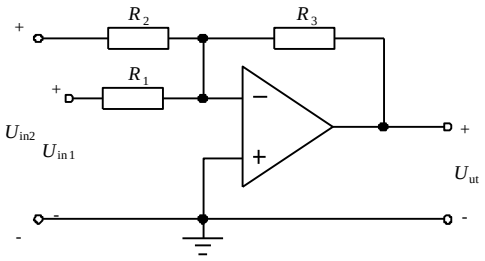
OP-kopplingar



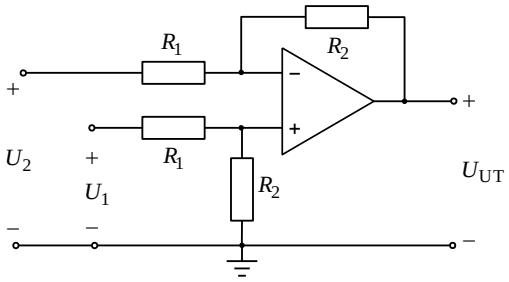
$$A_u = \frac{R_2 + R_1}{R_1}$$



$$A_u = -\frac{R_2}{R_1}$$



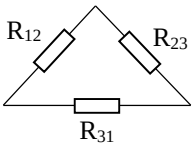
$$U_{ut} = -\left(\frac{R_3}{R_1}\cdot U_{in1} + \frac{R_3}{R_2}\cdot U_{in2}\right)$$

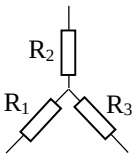


$$U_{UT} = \frac{R_2}{R_1}\cdot(U_1 - U_2)$$

Förstärkning $A_u(\text{dB}) = 20\cdot\log|A_u(\text{ggr})|$

D-Y och Y-D



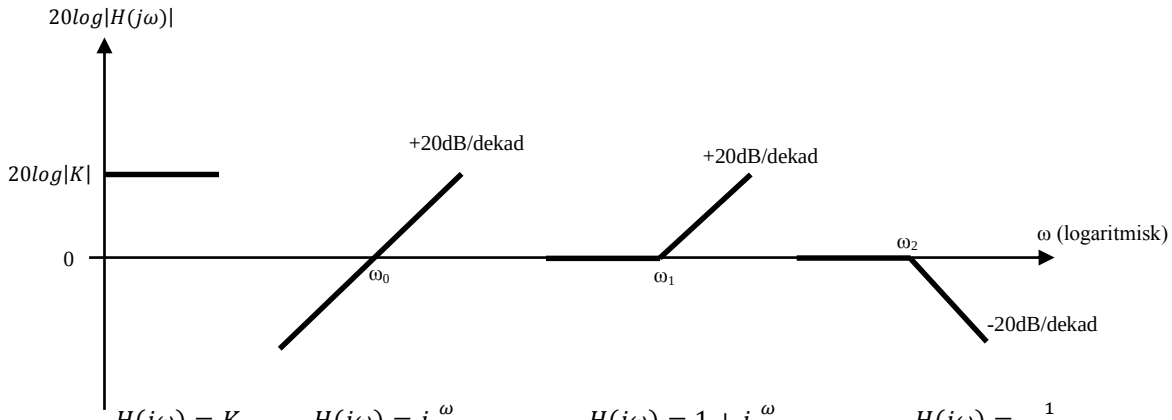


$$\boldsymbol{R_{12} = R_1 + R_2 + \frac{R_1 R_2}{R_3}} \qquad \boldsymbol{R_1 = \frac{R_{12}R_{31}}{R_{12}+R_{23}+R_{31}}}$$

$$\boldsymbol{R_{23} = R_2 + R_3 + \frac{R_2 R_3}{R_1}} \qquad \boldsymbol{R_2 = \frac{R_{12}R_{23}}{R_{12}+R_{23}+R_{31}}}$$

$$\boldsymbol{R_{31} = R_3 + R_1 + \frac{R_3 R_1}{R_2}} \qquad \boldsymbol{R_3 = \frac{R_{23}R_{31}}{R_{12}+R_{23}+R_{31}}}$$

Bodediagram



$$H(j\omega) = K \qquad H(j\omega) = j\frac{\omega}{\omega_0} \qquad H(j\omega) = 1 + j\frac{\omega}{\omega_1} \qquad H(j\omega) = \frac{1}{1+j\frac{\omega}{\omega_2}}$$

Komplexa tal

Rektangulär form: $z = a + jb$
Polär form : $z = r \cdot e^{j\phi}$
Eulers formel: $e^{j\phi} = \cos\phi + j \cdot \sin\phi$

Speciellt: $\frac{1}{j} = -j \qquad j = e^{j90^0} \qquad \frac{1}{j} = e^{-j90^0}$

Polär $\rightarrow$ Rektangulär : $z = r \cdot e^{j\phi} = a + jb$, där $a = r\cos\phi \qquad b = r\sin\phi$

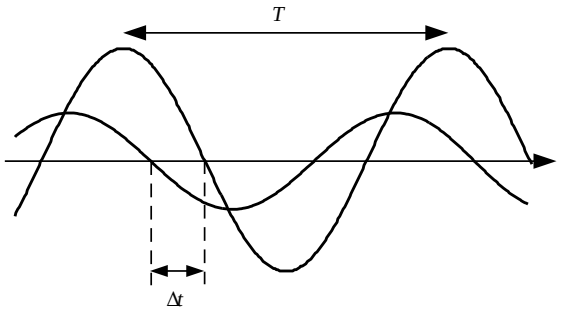
Rektangulär $\rightarrow$ Polär :

$z = a + jb = r \cdot e^{j\phi}$, där $r = |z| = \sqrt{a^2 + b^2}$ och

$$\phi = \arg z = \begin{cases} \arctan\frac{b}{a} & a > 0 \quad b > 0 \quad \text{1:a kvadranten} \\ \arctan\frac{b}{a} + 180^\circ & a < 0 \quad b > 0 \quad \text{2:a kvadranten} \\ \arctan\frac{b}{a} - 180^\circ & a < 0 \quad b < 0 \quad \text{3:e kvadranten} \\ \arctan\frac{b}{a} & a > 0 \quad b < 0 \quad \text{4:e kvadranten} \end{cases}$$

Samband mellan tid och vinkel: Tiden Δt motsvarar vinkeln $\varphi = \frac{\Delta t}{T} \cdot 360^\circ$,

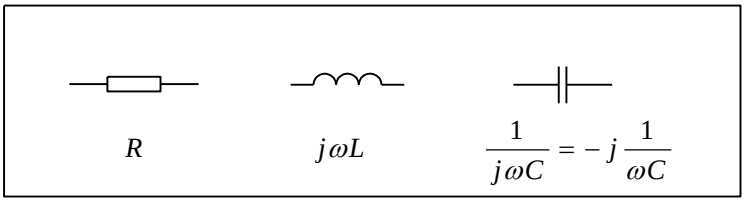
där T är periodtiden och frekvensen f ges av $f = \frac{1}{T}$



Komplexa metoden

$$|U|\sin(\omega t+\alpha) \leftrightarrow |U|e^{j(\omega t+\alpha)} = |U|e^{j\omega t}\cdot e^{j\alpha}$$
$$|I|\sin(\omega t+\beta) \leftrightarrow |I|e^{j(\omega t+\beta)} = |I|e^{j\omega t}\cdot e^{j\beta}$$

Ideala Passiva komponenter



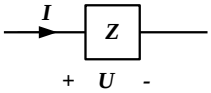
Impedans

$Z = |Z|\cdot e^{j\varphi} = |Z|\cdot\cos\varphi + j|Z|\cdot\sin\varphi = R + jX$, R = resistans X = reaktans

Induktiv: $\varphi > 0$ $X = \omega L$ $\omega = 2\pi f$

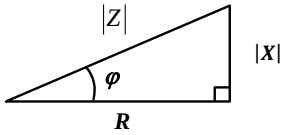
Kapacitiv: $\varphi < 0$ $X = -\dfrac{1}{\omega C}$ $\omega = 2\pi f$

”Ohms lag”: $U = Z\cdot I$



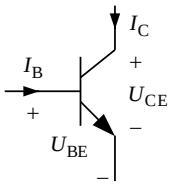
Växelströmseffekt: $P = U_e\cdot I_e\cdot\cos\varphi$ $U_e = \dfrac{|U|}{\sqrt{2}}$ $I_e = \dfrac{|I|}{\sqrt{2}}$

Impedanstriangeln:



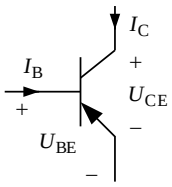
Transistorn För ledande, ej bottnad, transistor gäller att $I_C = h_{FE}\cdot I_B$ samt följande

NPN



$U_{BE} = 0{,}7\text{V}$
$U_{CE} > 0$ Bottnad om $U_{CE} \le 0{,}1\text{V}$ (U_{CEsat})
$I_C > 0$
$I_B > 0$

PNP



$U_{BE} = -0{,}7\text{V}$
$U_{CE} < 0$ Bottnad om $U_{CE} \ge -0{,}1\text{V}$ (U_{CEsat})
$I_C < 0$
$I_B < 0$