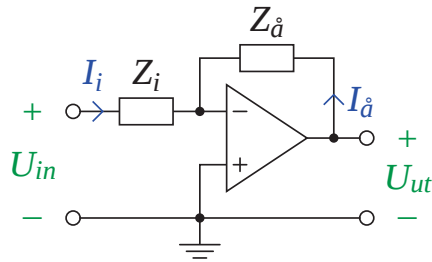


Aktivt LP-filter

Komplexschema



Givet

Förstärkning -10

Gränsfrekvens f_c

Inimpedans R_0

Impedanser

$$Z_i = R_i$$

$$Z_a = R_a \parallel \frac{1}{j\omega C_a}$$

Konstruktionsregel 1 ger att $V_- \approx V_+ = 0$. Inimpedans

$$Z_{in} = \frac{U_{in}}{I_i} \approx \frac{U_{in}}{\frac{U_{in} - 0}{R_i}} = R_i = R_0$$

Konstruktionsregel 2 ger att $I_- \approx 0$. Överföringsfunktion

$$U_{ut} = Z_a I_a = -Z_a I_i = -Z_a \frac{U_{in}}{Z_i} \Rightarrow H = -\frac{Z_a}{Z_i}$$

Amplitudkaraktistik

$$H = -\frac{R_a \frac{1}{j\omega C_a}}{R_i + \frac{1}{j\omega C_a}} = -\frac{R_a}{R_i} \frac{1}{j\omega R_a C_a + 1} \Rightarrow |H(\omega)| = \frac{R_a}{R_i} \frac{1}{\sqrt{1^2 + \omega^2 R_a^2 C_a^2}}$$

$$\left\{ \begin{array}{l} H(0) = -\frac{R_a}{R_i} = -10 \Rightarrow R_a = 10R_i \\ |H(\omega_c)| = \frac{10}{\sqrt{2}} \Rightarrow (1 + \omega_c^2 R_a^2 C_a^2) = \frac{2R_a^2}{100R_i^2} = 2 \Rightarrow \omega_c = \frac{1}{R_a C_a} \\ H(\infty) = 0 \end{array} \right.$$

Sökta komponentstorlekar R_i , R_a och C_a

$$R_i = R_0, \quad R_a = 10R_i = 10R_0, \quad f_c = \frac{1}{2\pi R_a C_a} \Rightarrow C_a = \frac{1}{2\pi f_c 10R_0}$$