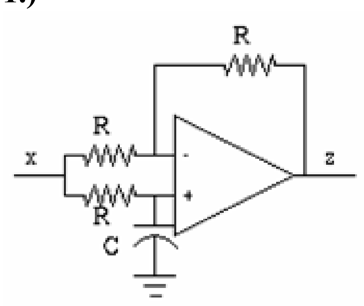
VAJE IZ ELEKTRONIKE (9) **7.12.2005**

PRENOSNE FUNKCIJE

1.)



$$\xi=\frac{1}{1+\tau p}x$$

$$\frac{x-\xi}{R}+\frac{z-\xi}{R}=0$$

$$x+z-2\frac{1}{1+\tau p}x=0$$

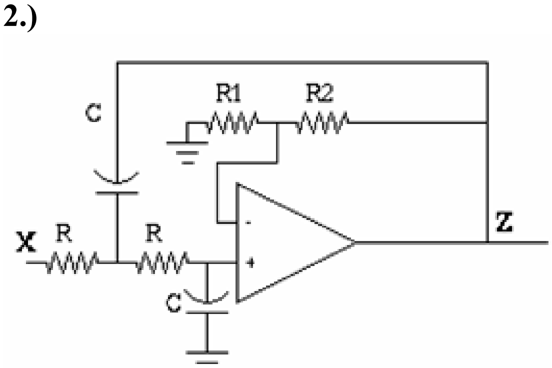
$$z=2\frac{1}{1+\tau p}x-x=\frac{1-\tau p}{1+\tau p}x$$

$$20\log(A)=20\log(|1-i\omega\tau|)-20\log(|1+i\omega\tau|)=20\log(\sqrt{1+\omega^2\tau^2})-20\log(\sqrt{1+\omega^2\tau^2})=0$$

$$\angle=\arctan(-\omega\tau)+\arctan(-\omega\tau)=-2\arctan(\omega\tau)$$

To je all pass filter prvega reda. Narišimo. Te filtre uporabljamo za kompenzacijo faze (časovnih zamikov) v različnih vezjih.

2.)



$$T(\hat{p})=\frac{\alpha}{1+\tau p(3-\alpha)+\tau^2p^2}\quad,\alpha=1+\frac{R_2}{R_1}$$

$$(1+\tau p(3-\alpha)+\tau^2p^2)z=\alpha x=0$$

$$\tau^2\ddot{z}+\tau(3-\alpha)\dot{z}+z=0\quad;\quad z=A\exp(\lambda t)$$

$$\tau^2\lambda^2+\tau(3-\alpha)\lambda+1=0$$

$$\lambda_{1,2}=\frac{-\tau(3-\alpha)\pm\sqrt{\tau^2(3-\alpha)^2-4\tau^2}}{2\tau^2}$$

Če je vsaj en od korenov z realnim delom večjim od 0 sistem ni stabilen – odplava do bodisi pozitivno ali negativno napajalno napetost. Torej pogoj za stabilnost je $\alpha<3$ ali $R_2/R_1<2$. Če je $\alpha=3$ dobimo dva kompleksna korena:

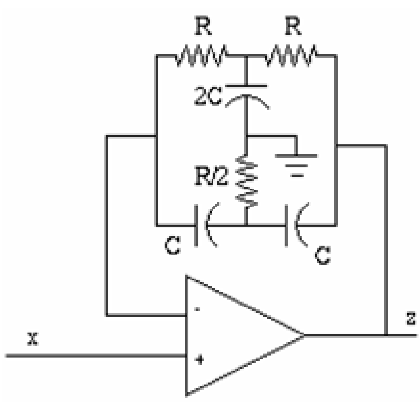
$$\lambda_{1,2} = \pm i\frac{1}{\tau}$$

$$z = A' \exp(i\frac{t}{\tau}) + B' \exp(-i\frac{t}{\tau})$$

$$z = A\cos(\frac{t}{\tau}) + B\sin(\frac{t}{\tau})$$

Izhod torej zaniha s frekvenco $\omega=1/\tau$ .Vrednost amplitud sta določeni z lastnostjo ojačevalca (vse do napajalne napetosti) in velikostjo uporov R_1 in R_2 .

3.) Zakaj to vezje ne dela?



$$TT = \frac{(\tau^2 p^2 + 1)}{\tau^2 p^2 + 4\tau p + 1}$$

$$A(x - \eta) = z$$

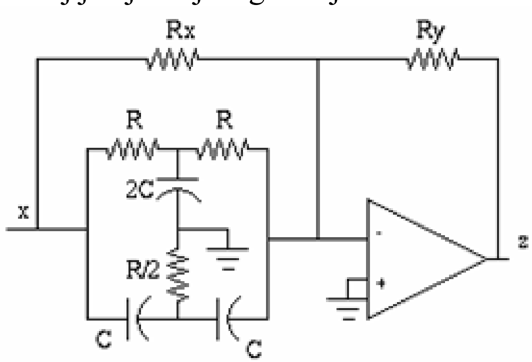
$$TTz = \eta \rightarrow z = TT^{-1}\eta$$

$$A \rightarrow \infty \quad , z = TT^{-1}x$$

$$z = \frac{\tau^2 p^2 + 4\tau p + 1}{\tau^2 p^2 + 1}x$$

Spet imamo čisto kompeksne korene!

4.) Kdaj je ojačanje tega vezja minimalno in koliko je tedaj?



$$\frac{z}{R_Y} + \frac{x}{R_x} + \frac{\eta}{R} + Cp\ \xi = 0$$

$$\frac{x-\eta}{R} - 2Cp\ \eta - \frac{\eta}{R} = 0 \to \eta = \frac{x}{2(1+\tau p)}$$

$$Cp\ (x-\xi) - 2\frac{\xi}{R} - Cp\ \xi = 0 \to \xi = \frac{\tau p x}{2(1+\tau p)}$$

$$\frac{z}{R_Y} + \frac{x}{R_x} + \frac{x}{2R(1+\tau p)} + \frac{Cp\ \ \tau p x}{2(1+\tau p)} = 0$$

$$z\frac{1}{R_Y} + \left(\frac{1}{2R(1+\tau p)} + \frac{Cp\ \ \tau p}{2(1+\tau p)} + \frac{1}{R_X}\right)x = 0$$

$$z = \frac{-R_Y}{R_X}\left(\frac{R_X + R_X\tau^2 p^2 + 2R(1+\tau p)}{2R(1+\tau p)}\right)x = \frac{-R_Y}{R_X}\left(\frac{(R_X+2R) + R_X\tau^2 p^2 + 2R\tau p}{2R(1+\tau p)}\right)$$

$$= \frac{-R_Y}{R_X}\left(\frac{(R_X+2R) - R_X\tau^2\omega^2 + 2Ri\ \tau\omega}{2R(1+i\tau\omega)}\right)$$

$$\left|\frac{z}{x}\right| = \left|\frac{-R_Y}{R_X}\left(\frac{(R_X+2R) - R_X\tau^2\omega^2 + 2Ri\ \tau\omega}{2R(1+i\tau\omega)}\right)\right|$$

$$\left|\frac{z}{x}\right|' = 0$$

$$(((R_X+2R) - R_X\tau^2\omega^2)^2 + 4R^2\tau^2\omega^2)' = 0$$

$$2((R_X+2R) - R_X y^2)(-2R_X y) + 8R^2 y = 0$$

$$-4R_X^{\ 2} - 8R^2 + 4R_X^{\ 2}y^2 + 8R^2 = 0$$

$$y = 1 \to \omega_{\min} = 1/\tau$$