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Piiriteoria II 2 7.2.2003. (Allowed to use graphic calculators)

1.Calculate the y parameters for the circuit in Fig.1.

2. Solve the transfer function Uo(s)/Ui(s) for the circuit in Fig.1 using y parameters. Draw pole-zero map, explain why (and if) the circuit is stable, and draw the Bode plots. Where are the biggest errors of the Bode approximations?

3. For circuit in Fig. 2, calculate $v_0(t)$ using Laplace transform, when $v_0(0) = 0$ ja $v_{in}$is a step function $u(t) \cdot 30$ V.

4. For the following transfer function H(s), draw the pole-zero plot and Bode amplitude and phase plots.

$$H(s) = \frac{10s^3}{(s^2+s+1)\cdot(s^2+4s+16)}$$

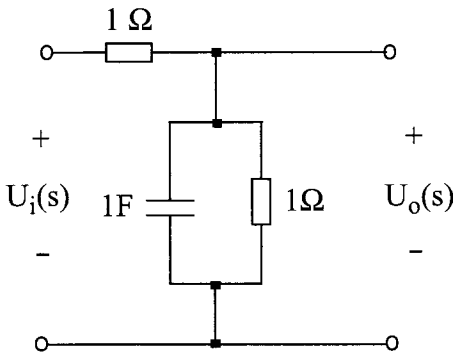

Fig 1

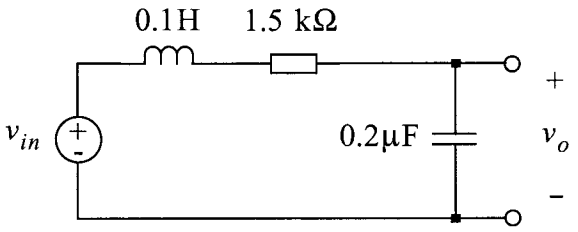

Fig 2

Taulukko 1. Verkon vahvistuksen laskeminen parametriesityksistä

	z	y	t
$A_i = I_2/I_1$	$\frac{-z_{21}}{z_{22}+Z_L}$	$\frac{y_{21}Y_L}{detY + y_{11}Y_L}$	$\frac{1}{D+CZ_L}$
$A_u = U_2/U_1$	$\frac{z_{21}Z_L}{detZ + z_{11}Z_L}$	$\frac{-y_{21}}{y_{22}+Y_L}$	$\frac{Z_L}{B+AZ_L}$

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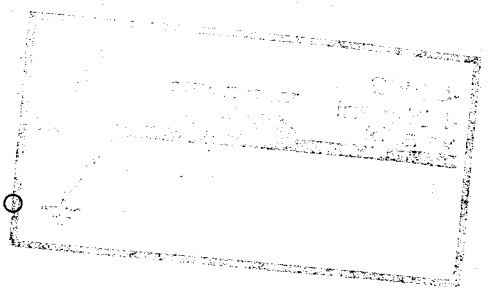

Taulukko 2. Calculating gain using z, y and t parameters

	x(t)	X(s)
impulse	$\delta(t)$	1
unit step	1	$1 / s$
ramp	t	$1 / s^2$
nth power	t^n	$n! / s^{n+1}$
ath power (a>0)	$t^{a-1} / \Gamma(a)$	$1 / s^a$
	$1 / \sqrt{(\pi t)}$	$1 / \sqrt{s}$
exp.function	e^{-at}	$1 / (s+a)$
	$1 - e^{-at}$	$a / (s(s+a))$
	$t^n e^{-at}$	$n! / (s+a)^{n+1}$
sine	$\sin(\omega t)$	$\omega / (s^2+\omega^2)$
cosine	$\cos(\omega t)$	$s / (s^2+\omega^2)$
sinh	sinh(at)	$a / (s^2-a^2)$
cosh	cosh(at)	$s / (s^2-a^2)$
linearity	ax(t) + by(t)	aX(s) + bY(s)
frequency shift	$e^{-at} x(t)$	X(s+a)
time shift	x(t-T)	$e^{-sT} X(s)$
time derivative	$dx(t) / dt$	sX - x(0)
nth time derivative	$d^n x(t) / dt^n$	$s^n X(s) - s^{n-1} x(0) - s^{n-2} x^{(1)}(0) \ldots - x^{(n-1)}(0)$
time integral	$\int_o^t x(t)dt$	$\frac{X(s)}{s} + \frac{1}{s} \cdot \int_{-\infty}^{0} x(t)dt$
convolution	$\int_o^t x(\tau)g(t-\tau)d\tau$	G(s)X(s)
frequency derivative	$(-t)^n x(t)$	$d^n X(s) / ds^n$