

Tema 2

Elemente de electronică analogică

Călin Jugănar, 324CA

Universitatea POLITEHNICA din București

Facultatea de Automatică și Calculatoare

`calin_vlad.juganaru@stud.acs.upb.ro`

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1 Calcularea impedanței capacității

- $C_p = 310 \text{ nF}$
- $R_p = 120 \text{ k}\Omega$
- $R_s = 25 \text{ k}\Omega$
- $f_0 = 250 \text{ kHz}$
- $f_f = 600 \text{ kHz}$
- $A_{pp} = 1 \text{ V}$
- $D_{of} = 0.5 \text{ V}$
- $n = 16$

$$Z_{C_p} = \frac{1}{j\omega C_p} = \frac{-j}{\omega C_p} = \frac{-j}{2\pi f C_p}$$
$$f = f_0 \Rightarrow Z_{C_p} = \frac{-j}{2 \cdot 3.14 \cdot 310 \cdot 10^{-9} \cdot 250 \cdot 10^3} = -2j \cdot 10^3$$
$$f = f_f \Rightarrow Z_{C_p} = \frac{-j}{2 \cdot 3.14 \cdot 310 \cdot 10^{-9} \cdot 600 \cdot 10^3} = -0.86j \cdot 10^3$$

2 Calcularea magnitudinii și fazei

$$Z_p = C_p || R_p = Z_{C_p} || Z_{R_p}$$
$$\Rightarrow Z_p = \frac{Z_{C_p} \cdot Z_{R_p}}{Z_{C_p} + Z_{R_p}} = \frac{R_p \cdot Z_C}{R_p + Z_C} = \frac{\frac{R_p}{j\omega C_p}}{\frac{1}{j\omega C_p} + R_p} = \frac{R_p}{1 + j\omega C_p R_p} = \frac{R_p(1 - j\omega C_p R_p)}{1 + \omega^2 C_p^2 R_p^2}$$
$$\Rightarrow Z_p = \frac{R_p}{1 + \omega^2 C_p^2 R_p^2} - j \frac{\omega C_p R_p^2}{1 + \omega^2 C_p^2 R_p^2}$$
$$Re = \frac{R_p}{1 + \omega^2 C_p^2 R_p^2}$$
$$Im = -\frac{\omega C_p R_p^2}{1 + \omega^2 C_p^2 R_p^2}$$
$$f \in [f_0, f_f], \omega = 2\pi f$$
$$Z_T = Z_p + Z_s = Z_p + R_s = (Re + R_s) + j \cdot Im$$
$$\phi_{rad} = \arctg\left(\frac{Im}{Re}\right)$$
$$\phi_{grade} = \frac{180}{\pi} \cdot \phi_{rad}$$
$$M = \sqrt{Re^2 + Im^2}$$

Pentru Z_p :

frecvența	impedanța	magnitudinea	faza (radiani)	faza (grade)
2.5000e+05	3.5144e-05 + 2.0536e+00i	2.05361	1.57078	89.99902
2.6842e+05	3.0486e-05 + 1.9127e+00i	1.91268	1.57078	89.99909
2.8684e+05	2.6696e-05 + 1.7898e+00i	1.78985	1.57078	89.99915
3.0526e+05	2.3571e-05 + 1.6818e+00i	1.68184	1.57078	89.99920
3.2368e+05	2.0965e-05 + 1.5861e+00i	1.58612	1.57078	89.99924
3.4211e+05	1.8768e-05 + 1.5007e+00i	1.50072	1.57078	89.99928
3.6053e+05	1.6899e-05 + 1.4240e+00i	1.42404	1.57078	89.99932
3.7895e+05	1.5296e-05 + 1.3548e+00i	1.35481	1.57079	89.99935
3.9737e+05	1.3911e-05 + 1.2920e+00i	1.29201	1.57079	89.99938
4.1579e+05	1.2705e-05 + 1.2348e+00i	1.23477	1.57079	89.99941
4.3421e+05	1.1650e-05 + 1.1824e+00i	1.18238	1.57079	89.99944
4.5263e+05	1.0721e-05 + 1.1343e+00i	1.13426	1.57079	89.99946
4.7105e+05	9.8991e-06 + 1.0899e+00i	1.08991	1.57079	89.99948
4.8947e+05	9.1680e-06 + 1.0489e+00i	1.04889	1.57079	89.99950
5.0789e+05	8.5151e-06 + 1.0108e+00i	1.01085	1.57079	89.99952
5.2632e+05	7.9294e-06 + 9.7547e-01i	0.97547	1.57079	89.99953
5.4474e+05	7.4022e-06 + 9.4248e-01i	0.94248	1.57079	89.99955
5.6316e+05	6.9259e-06 + 9.1165e-01i	0.91165	1.57079	89.99956
5.8158e+05	6.4941e-06 + 8.8277e-01i	0.88277	1.57079	89.99958
6.0000e+05	6.1015e-06 + 8.5567e-01i	0.85567	1.57079	89.99959

Pentru Z_T :

frecvența	impedanța	magnitudinea	faza (radiani)	faza (grade)
2.5000e+05	2.5000e+04 + 2.0536e+00i	2.5000e+04	8.2144e-05	4.7065e-03
2.6842e+05	2.5000e+04 + 1.9127e+00i	2.5000e+04	7.6507e-05	4.3835e-03
2.8684e+05	2.5000e+04 + 1.7898e+00i	2.5000e+04	7.1594e-05	4.1020e-03
3.0526e+05	2.5000e+04 + 1.6818e+00i	2.5000e+04	6.7274e-05	3.8545e-03
3.2368e+05	2.5000e+04 + 1.5861e+00i	2.5000e+04	6.3445e-05	3.6351e-03
3.4211e+05	2.5000e+04 + 1.5007e+00i	2.5000e+04	6.0029e-05	3.4394e-03
3.6053e+05	2.5000e+04 + 1.4240e+00i	2.5000e+04	5.6962e-05	3.2637e-03
3.7895e+05	2.5000e+04 + 1.3548e+00i	2.5000e+04	5.4193e-05	3.1050e-03
3.9737e+05	2.5000e+04 + 1.2920e+00i	2.5000e+04	5.1680e-05	2.9611e-03
4.1579e+05	2.5000e+04 + 1.2348e+00i	2.5000e+04	4.9391e-05	2.8299e-03
4.3421e+05	2.5000e+04 + 1.1824e+00i	2.5000e+04	4.7295e-05	2.7098e-03
4.5263e+05	2.5000e+04 + 1.1343e+00i	2.5000e+04	4.5371e-05	2.5995e-03
4.7105e+05	2.5000e+04 + 1.0899e+00i	2.5000e+04	4.3596e-05	2.4979e-03
4.8947e+05	2.5000e+04 + 1.0489e+00i	2.5000e+04	4.1956e-05	2.4039e-03
5.0789e+05	2.5000e+04 + 1.0108e+00i	2.5000e+04	4.0434e-05	2.3167e-03
5.2632e+05	2.5000e+04 + 9.7547e-01i	2.5000e+04	3.9019e-05	2.2356e-03
5.4474e+05	2.5000e+04 + 9.4248e-01i	2.5000e+04	3.7699e-05	2.1600e-03
5.6316e+05	2.5000e+04 + 9.1165e-01i	2.5000e+04	3.6466e-05	2.0893e-03
5.8158e+05	2.5000e+04 + 8.8277e-01i	2.5000e+04	3.5311e-05	2.0232e-03
6.0000e+05	2.5000e+04 + 8.5567e-01i	2.5000e+04	3.4227e-05	1.9611e-03

3 Reprezentarea grafică (frecvență, magnitudine)

