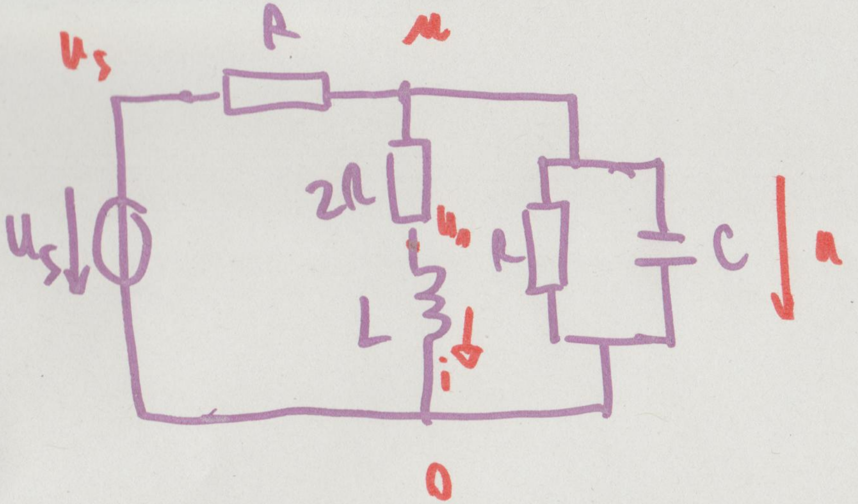
MR 726



$$i + Cu' + \frac{u-u_s}{R} + \frac{u}{R} = 0$$
$$Li' + i\cdot 2R = u$$

$$i' = -\frac{2R}{L}i + \frac{1}{L}u$$
$$u' = -\frac{1}{C}i - \frac{2}{RC}u + \frac{1}{RC}u_s$$

$$\underline{\underline{A}} = \begin{pmatrix} -\frac{2R}{L} & \frac{1}{L} \\ -\frac{1}{C} & -\frac{2}{RC} \end{pmatrix} ; \quad \left(\lambda + \frac{2R}{L}\right)\left(\lambda + \frac{2}{RC}\right) + \frac{1}{LC} = 0 \quad \lambda^2 + \lambda\overbrace{\left(\frac{2R}{L} + \frac{2}{RC}\right)}^{\frac{2R^2C+2L}{CLR}} + \overbrace{\left(\frac{1}{LC} + \frac{4}{LC}\right)}^{5/LC} = 0$$

stabil, mert Hurwitz-polinom

lengő jelleg?

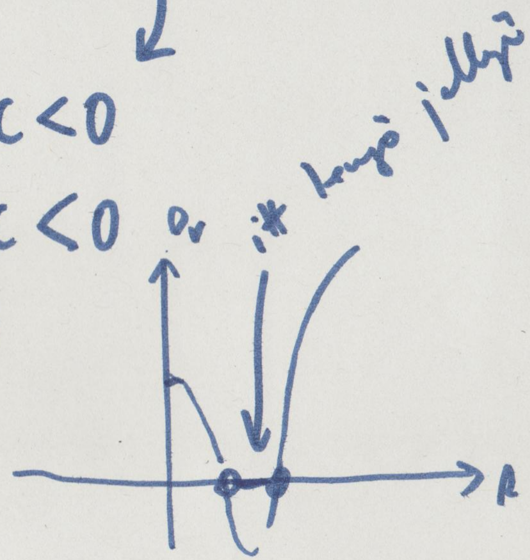
$$\left(\frac{2(R^2C+L)}{CLR}\right)^2 - 4\cdot\frac{5}{LC} < 0$$

$$2^2(R^2C+L)^2 - 20\cdot R\cdot RLC < 0$$

$$(R^2C)^2 + 2L\cdot R^2C + L^2 - 5R^2LC < 0$$

$$(R^2)^2\cdot C^2 - 3LC\cdot R^2 + L^2 < 0$$

$$R = \begin{cases} 0{,}6180 \\ 1{,}6180 \end{cases}$$



Lösung: $R = 0{,}5\,k\Omega$; $L = 1\,mH$; $C = 1\,nF$

MR72b/2

$u_s(t) = 10V \cdot \varepsilon(t)$

1) $\underline{\underline{A}} = \begin{pmatrix} -1 & 1 \\ -1 & -4 \end{pmatrix}$; $\underline{B} = \begin{pmatrix} 0 \\ 2 \end{pmatrix}$; $\underline{C}^T = (1\ 0)$; $D = 0$;

2) $\lambda_1 = -1{,}3820\,\mu s^{-1}$ $\underline{m}_1 = \begin{pmatrix} 0{,}9342 \\ -0{,}3568 \end{pmatrix}$

$\lambda_2 = -3{,}6180\,\mu s^{-1}$ $\underline{m}_2 = \begin{pmatrix} -0{,}3568 \\ 0{,}9342 \end{pmatrix}$

3) $\underline{X}_g = \begin{pmatrix} I \\ U \end{pmatrix}$ $\underline{X}_g = \underline{\underline{A}}^{-1} \cdot (-\underline{B} \cdot U_0)$

$X_g = \begin{pmatrix} 4 \\ 4 \end{pmatrix}$

4) $t = 0$ $\underline{x}(0) = 0$ $\underline{x} = k_1 \underline{m}_1 e^{\lambda_1 t} + k_2 \underline{m}_2 e^{\lambda_2 t} + \underline{X}_g$

$\underline{\underline{m}} \cdot \begin{pmatrix} k_1 \\ k_2 \end{pmatrix} + \underline{X}_g = 0$ $\underline{k} = \underline{\underline{m}}^{-1} \cdot (-\underline{X}_g)$

$\underline{k} = \begin{pmatrix} -6{,}9282 \\ -6{,}9282 \end{pmatrix}$

5) $i = x_1 = -6{,}4721 \cdot e^{-1{,}3820 t} +$

$+ 2{,}4721 \cdot e^{-3{,}618 \cdot t} + 4$

$u = x_2 = 2{,}4721\, e^{-1{,}382 \cdot t} - 6{,}4721\, e^{-3{,}618 t} +$

$+ 4$

$t > 0$

legyen $L = 1\ mH$; $C = 1\ nF$; $R = 1\ k\Omega$

$u_s(t) = 1V \cdot \varepsilon(t)$ V, mA, μs, kΩ, mH, nF

→ válasz a 2R-es feszültsége

$$\underline{\underline{A}} = \begin{pmatrix} -\frac{2R}{L} & \frac{1}{L} \\ -\frac{1}{C} & -\frac{2}{RC} \end{pmatrix}; \quad \underline{B} = \begin{pmatrix} 0 \\ \frac{1}{RC} \end{pmatrix}$$

$$\underline{C}^T = (2R \quad 0); \quad \underline{D} = 0$$

1) $$\underline{\underline{A}} = \begin{pmatrix} -2 & 1 \\ -1 & -2 \end{pmatrix}; \quad \underline{B} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}; \quad \underline{C}^T = (2 \quad 0); \quad D = 0;$$

2) $$\underline{\lambda}_1 = (-2+j)\ \mu s^{-1} \quad \underline{m}_1 = \begin{pmatrix} \sqrt{2} \\ +\sqrt{2}j \end{pmatrix} \cdot \frac{1}{\sqrt{2}}$$

$$\underline{\lambda}_2 = (-2-j)\ \mu s^{-1} \quad \underline{m}_2 = \begin{pmatrix} \sqrt{2} \\ -\sqrt{2}j \end{pmatrix} \cdot \frac{1}{\sqrt{2}}$$

MR726/3

3) $$\underline{X}_g = \begin{pmatrix} I \\ U \end{pmatrix} \quad \underline{\underline{A}} \cdot \underline{X}_g + \underline{B} \cdot U_0 = 0$$

$$\underline{X}_g = \underline{\underline{A}}^{-1} \cdot (-\underline{B} \cdot U_0) = \begin{pmatrix} 0,2 \\ 0,4 \end{pmatrix}$$

4) $t = 0$-ban $\underline{x}(0) = 0$, belépő konstans gerjesztés

$$0 = \underline{m}_1 \cdot k_1 + \underline{m}_2 \cdot k_2 + \underline{X}_g$$

$$\underline{\underline{m}} \cdot \begin{pmatrix} k_1 \\ k_2 \end{pmatrix} + \underline{X}_g = 0$$

$$\underline{k} = \underline{\underline{m}}^{-1} \cdot (-\underline{X}_g) = 0,1414 \cdot \begin{pmatrix} -1+2j \\ -1-2j \end{pmatrix}$$

$$x_1 = i = k_1 \cdot m_{11} \cdot e^{\lambda_1 t} + k_2 \cdot m_{12} \cdot e^{\lambda_2 t} + x_{g1}$$

$$x_2 = u = k_1\, m_{21}\, e^{\lambda_1 t} + k_2 \cdot m_{22} \cdot e^{\lambda_2 t} + x_{g2}$$

$$\begin{array}{cc} \underline{m}_1 & \underline{m}_2 \\ \end{array}$$

$$\underline{\underline{m}} = \begin{pmatrix} m_{11} & m_{12} \\ m_{21} & m_{22} \end{pmatrix}$$

azonban ez komplex

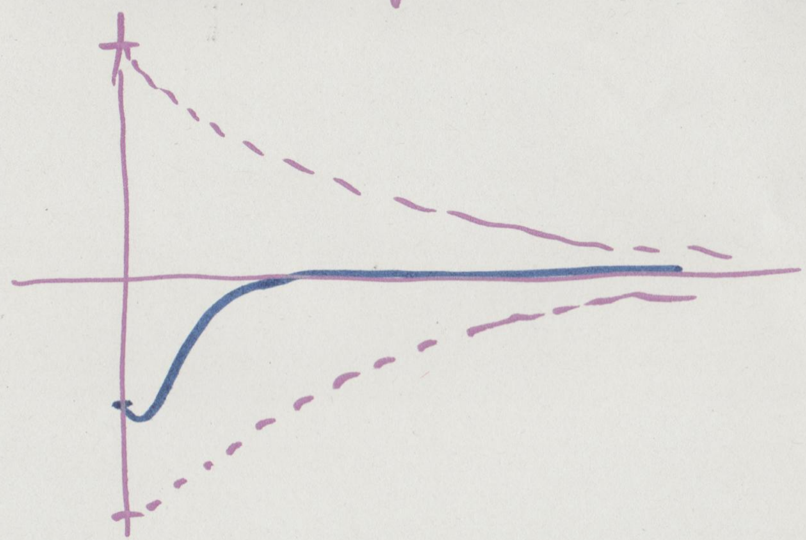
$$i = \underbrace{(-0{,}1+0{,}2j)}_{0{,}2236\, e^{j2{,}03}}\ \underbrace{e^{(-2+j)t}}_{e^{-2t}\cdot e^{jt}} + \underbrace{(-0{,}1-0{,}2j)}_{0{,}2236\, e^{-j2{,}03}}\ \underbrace{e^{(-2-j)t}}_{e^{-2t}\cdot e^{-jt}} + 0{,}2 =$$

$$e^{jx}+e^{-jx} = (\cos x + j\sin x) + (\cos x - j\sin x) = 2\cdot\cos x$$

$$= 0{,}2236\, e^{j2{,}03} e^{-2t} e^{jt} + 0{,}2236\, e^{-j2{,}03}\cdot e^{-2t}\cdot e^{-jt} + 0{,}2 =$$

$$= 0{,}2236\,(e^{-2t})\cdot \underbrace{\left\{e^{jt}\cdot e^{j2{,}03} + e^{-jt}\, e^{-j2{,}03}\right\}}_{\text{lásd fent } x=(t+2{,}03)} + 0{,}2 = \underbrace{2\cdot 0{,}2236\cdot e^{-2t}\cdot \cos(t+2{,}03)} + 0{,}2$$

$2\cdot\cos(t+2{,}03)$



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