2007.10.19 péntek

~~XIII.~~ XIV. Előadás (6. hét)

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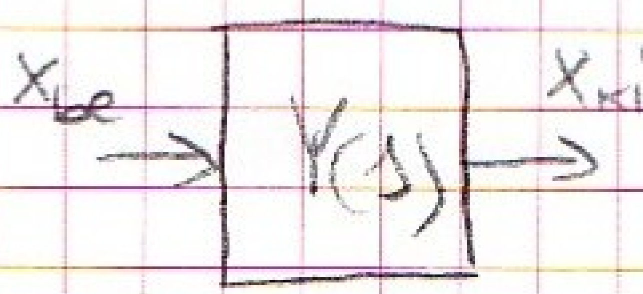
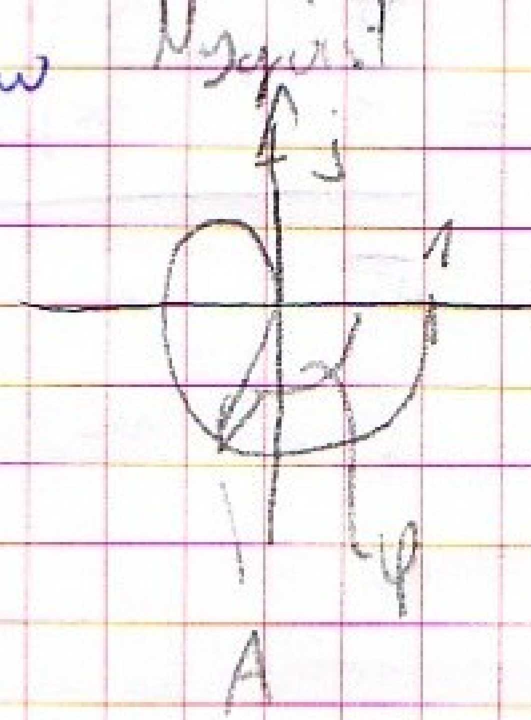
Szűrők vizsgálata

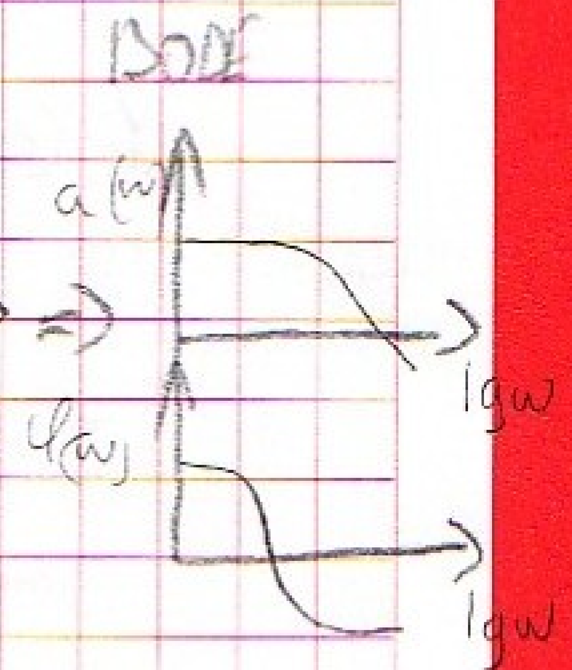
Szűrő



$$\frac{x_{ki}(s)}{x_{be}(s)} = Y(s) \Rightarrow s = j\omega$$

$$\overline{Y}(j\omega) = \frac{\overline{x}_{ki}(j\omega)}{\overline{x}_{be}(j\omega)}$$





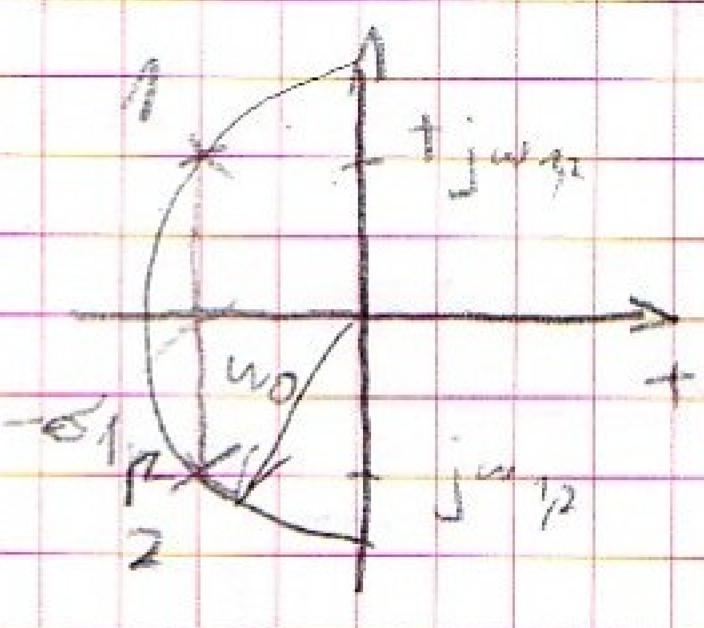
$a(\omega) = 20\lg A(\omega)$
$\varphi(\omega)$

$$Y(s) = \frac{a_0 + a_1 s + a_2 s^2 + \ldots + a_m s^m}{b_0 + b_1 s + b_2 s^2 + \ldots + b_n s^n} =$$

$$= \frac{a_0}{b_0} \frac{1 + \frac{a_1}{a_0} s + \frac{a_2}{a_0} s^2 + \ldots + \frac{a_m}{a_0} s^m}{1 + \frac{b_1}{b_0} s + \frac{b_2}{b_0} s^2 + \ldots \frac{b_n}{b_0} s^n} \qquad m \le n$$

$$= \frac{a_m}{b_n} \frac{\frac{a_0}{a_m} + \frac{a_1}{a_m} s + \ldots + s^m}{\frac{b_0}{b_n} + \frac{b_1}{b_n} s + \ldots + s^n} \quad \begin{matrix} \Rightarrow \text{zérushelyek} \\ \Rightarrow \text{pólushelyek} \end{matrix}$$

$$Y(s) = \frac{\prod_{i=1}^{m} (s - z_i)}{\prod_{j=1}^{n} (s - p_j)} \Rightarrow \frac{\prod_{i=1}^{m} \left(1 - \frac{s}{z_i}\right)}{\prod_{j=1}^{n} \left(1 - \frac{s}{p_j}\right)}$$



$$(s - s_1)(s - s_2) = (s + \sigma_{1,2} - j\omega_{1,2})(s + \sigma_{1,2} + j\omega_{1,2}) \quad \boxed{\begin{aligned} s_1 &= -\sigma_{1,2} + j\omega_{1,2} \\ s_2 &= -\sigma_{1,2} - j\omega_{1,2} \end{aligned}}$$

$$= \cancel{s^2 + \sigma_{1,2} s - j\omega_{1,2} + \sigma_{1,2}}$$

$$= s^2 + 2\sigma_{1,2} s + \overbrace{\sigma_{1,2}^2 + \omega_{1,2}^2}^{\omega_0^2}$$

$$s^2 + s\,2\delta_{1,2} + w_0^2 \Rightarrow w_0^2\left(\frac{1}{w_0^2}s^2 + s\frac{2\delta_{1,2}}{w_0^2} + 1\right) \Rightarrow w_0^2\left(\frac{s^2}{w_0^2} + s\frac{1}{w_0 Q} + 1\right)$$

$$\frac{1}{w_0 \frac{w_0}{2\delta_{1,2}}}$$

jósági tényező

$$\Rightarrow \frac{1}{\frac{s^2}{w_0^2} + \frac{s}{w_0 Q} + 1}$$

$$Y(s) = \frac{\prod_k \left(1 + \frac{s}{w_k}\right) \prod_g \left(1 + \frac{s}{w_{0zg} Q_{zg}} + \frac{s^2}{w_{0zg}^2}\right)}{\prod_l \left(1 + \frac{s}{w_l}\right) \prod_r \left(1 + \frac{s}{w_{0pr} Q_{pr}} + \frac{s^2}{w_{0pr}^2}\right)}$$

$$A(t) \Rightarrow F(s)$$

$$\frac{d}{dt}A(t) \Leftrightarrow s\,F(s)$$

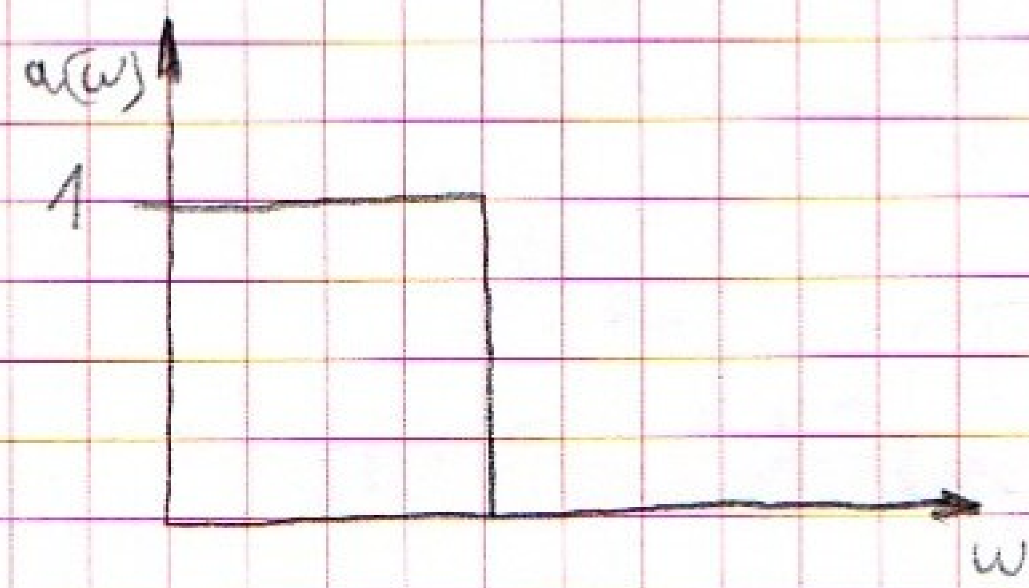
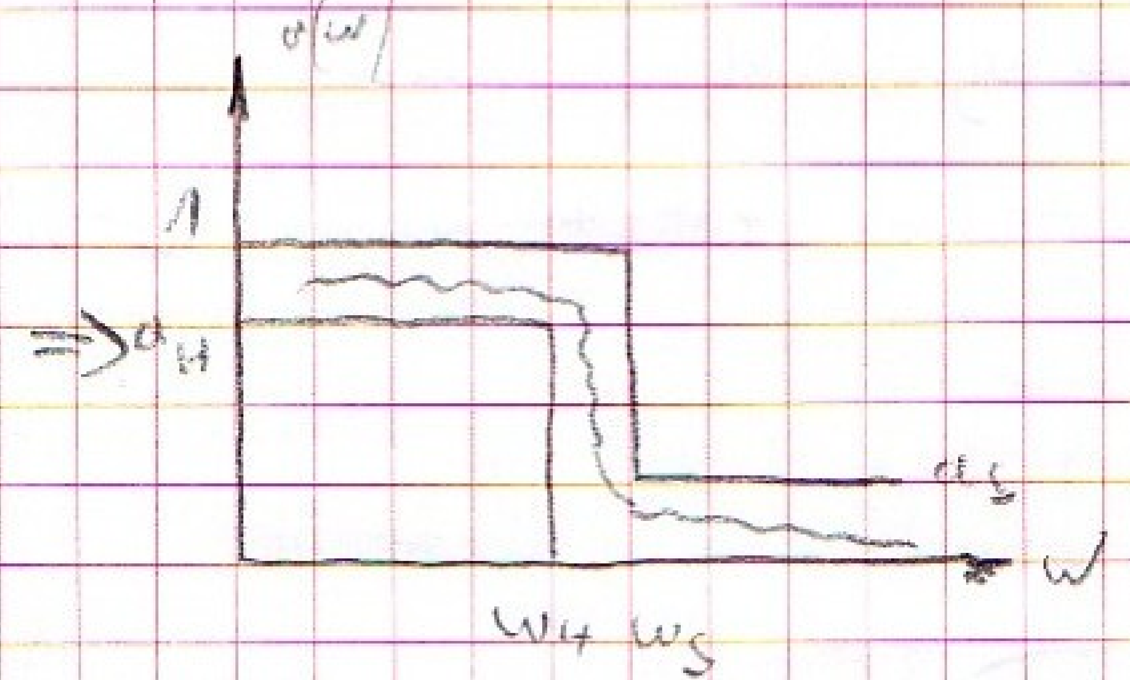
$$\frac{1}{s^2T^2 + 2Ts + 1} \qquad \frac{1}{w_0^2} = T^2 \Rightarrow T = \frac{1}{w_0} \Rightarrow w_0 = \frac{1}{T}$$

$$\frac{1}{w_0 Q} = 2\xi T = \frac{2\xi}{w_0} \Rightarrow Q = \frac{1}{2\xi}$$

$$0 \le \xi \le 1$$

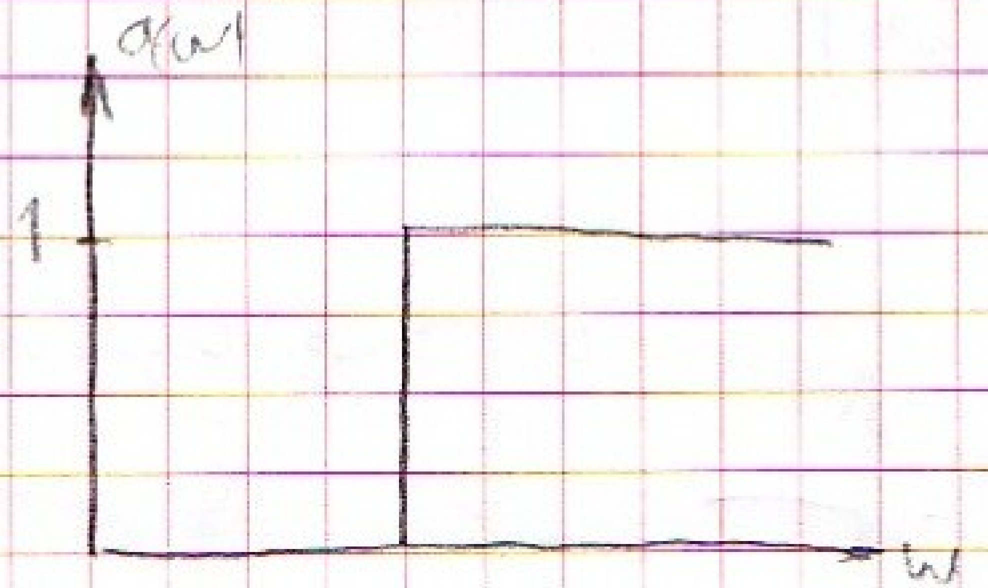
$$\frac{1}{2} \le Q \le \infty$$

1. Specifikáció
2. Approximáció
3. Realizáció
4. Tűrésviszonyok

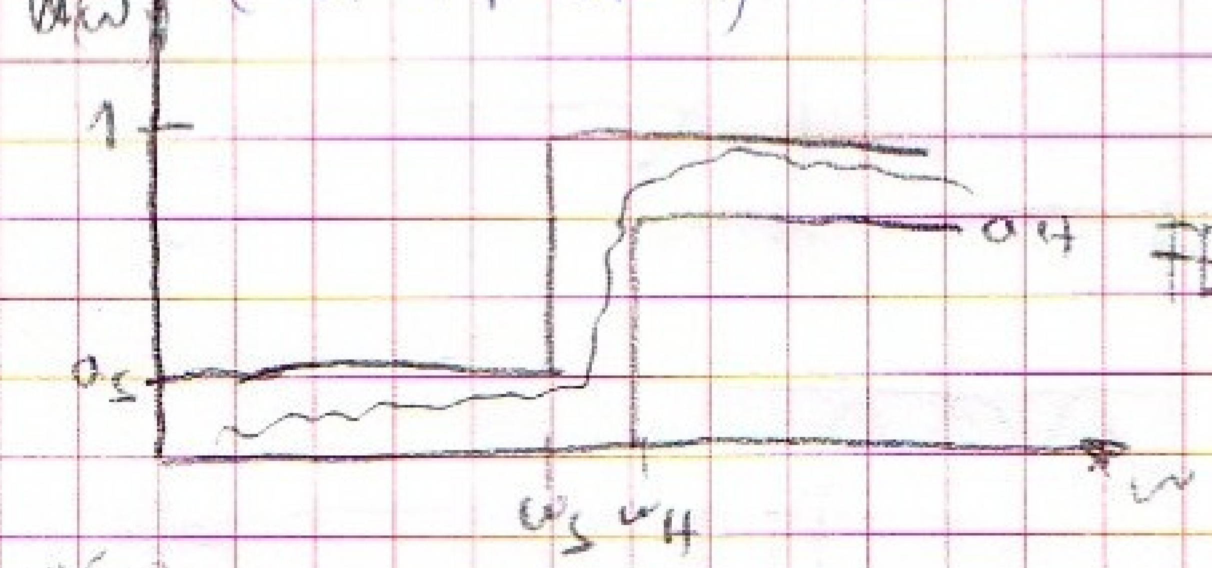



ALULÁTERESZTŐ

ÁSZ

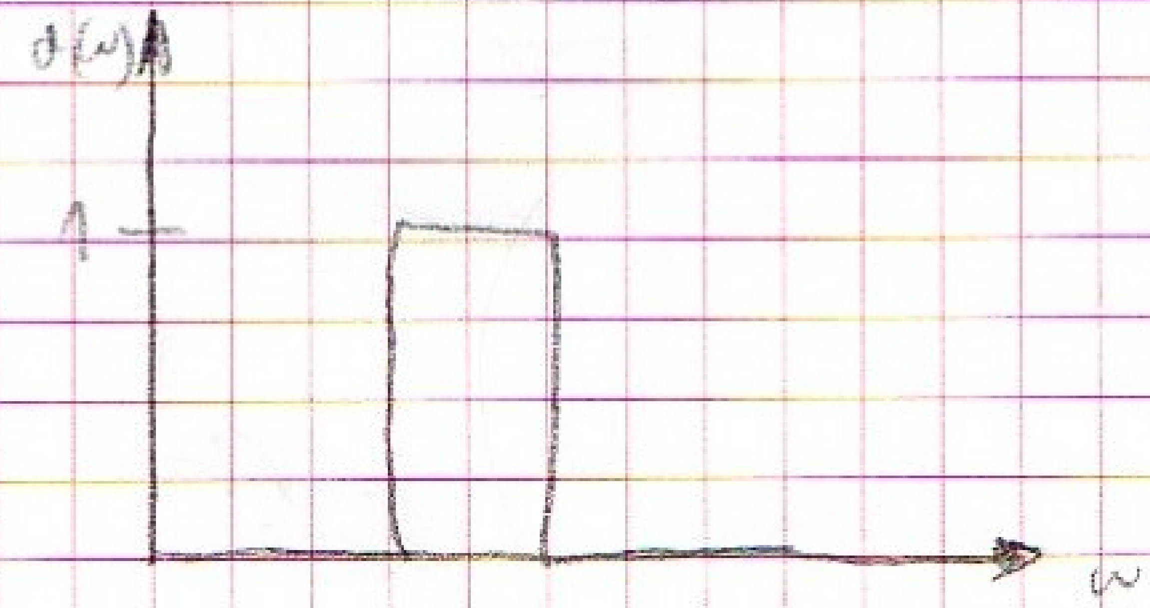
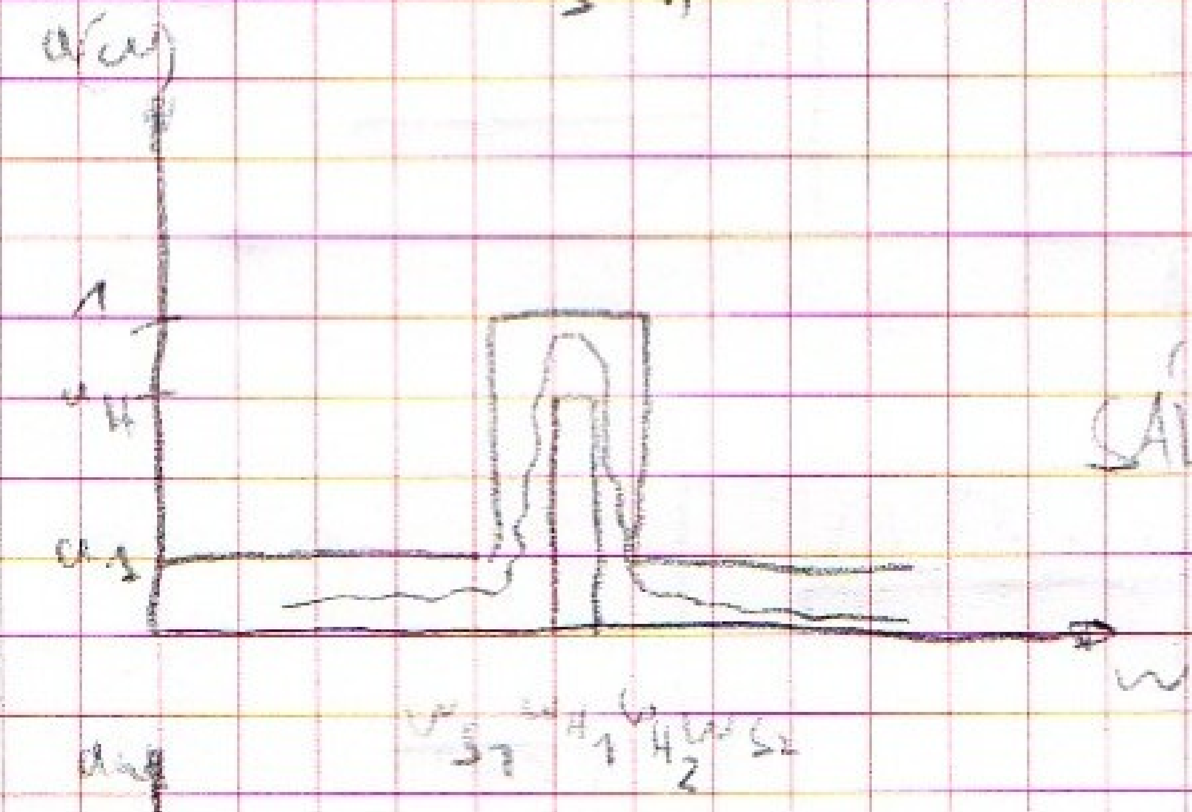


$(a_S, a_H, \omega_S, \omega_H)$



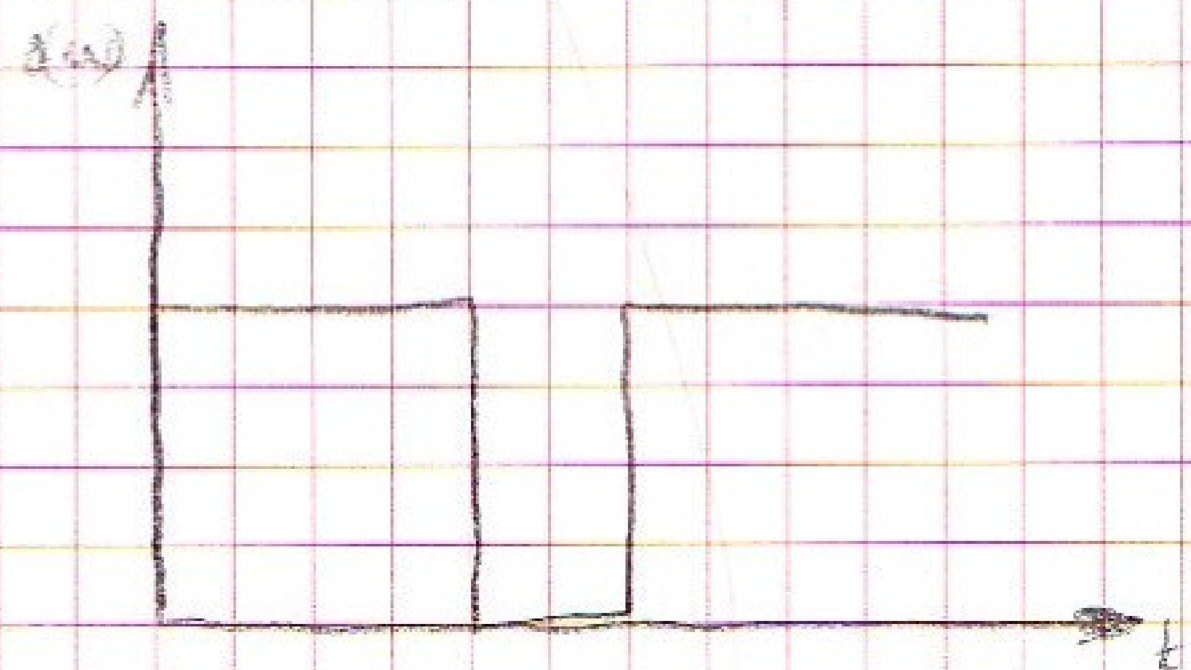
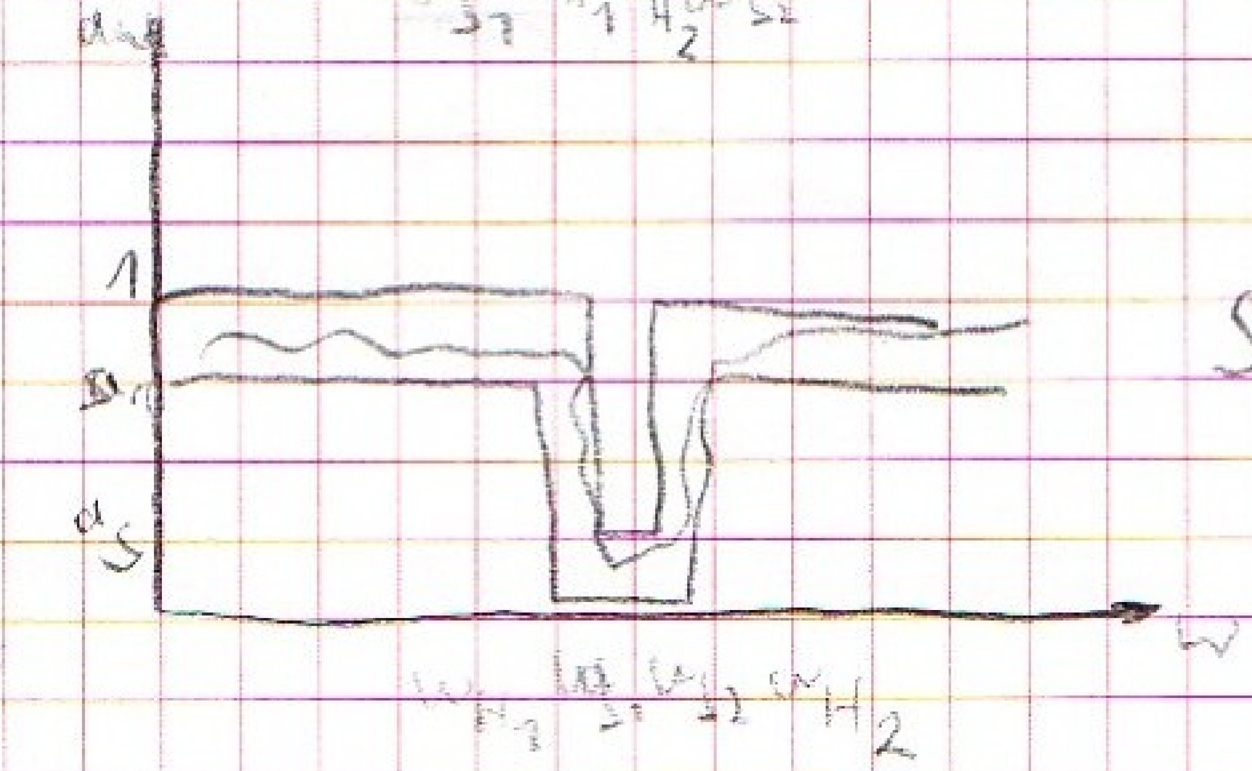
FELÜL –||–

FSZ

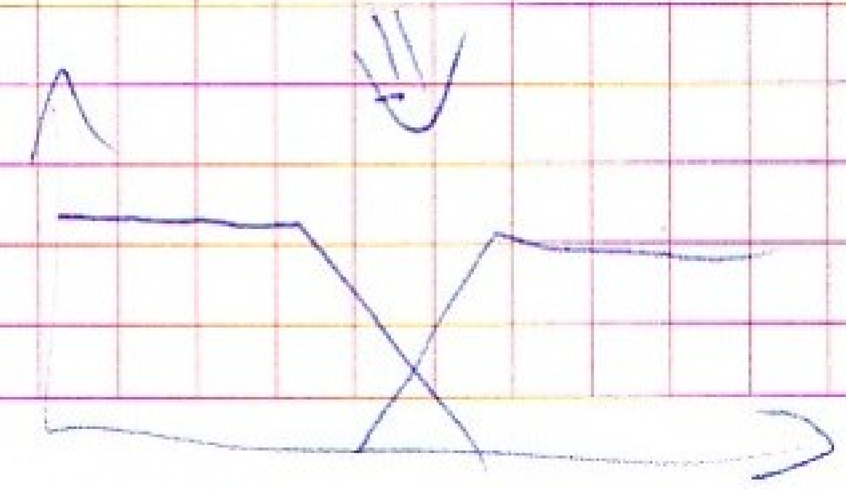
SÁVÁTERESZ

SÁSZ

SÁVZÁRÓ

SZSZ



① Butterworth — max laposságú lyuk szűrő

② Legendre — végig monoton

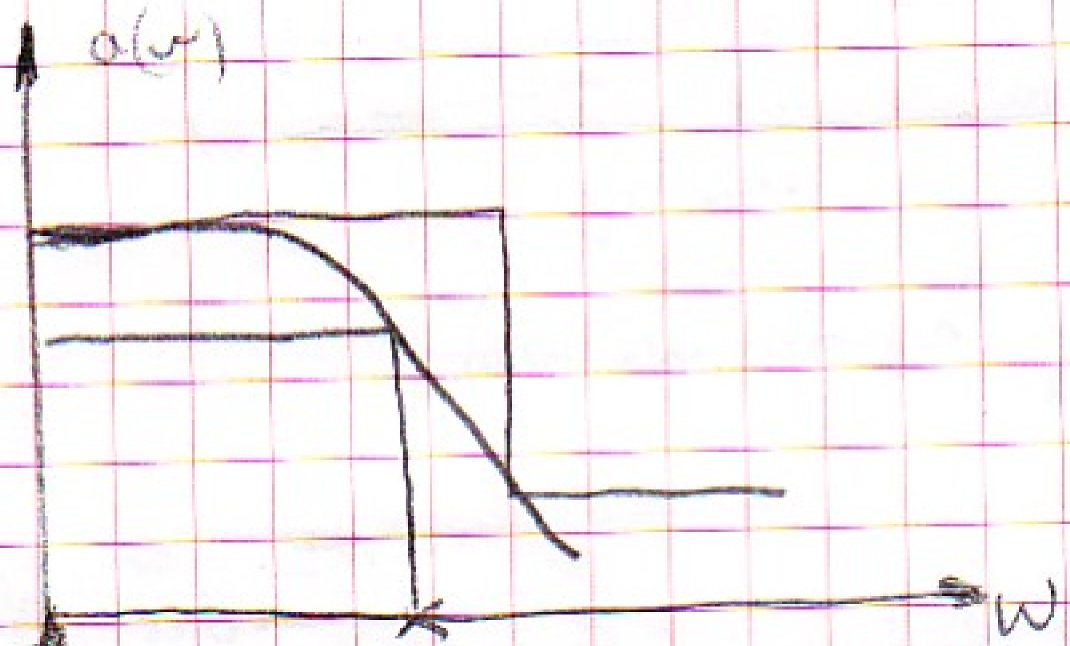
③ Csebisev — zárósávban monoton

④ Inverz Csebisev — áteresztősávban monoton

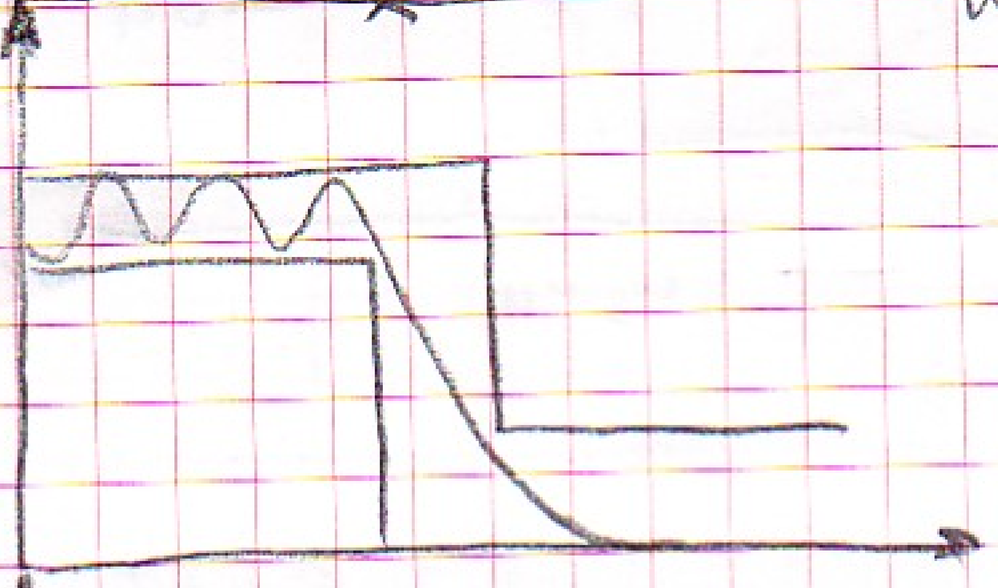
⑤ Legjobb ugrásátvitelű — Thomson

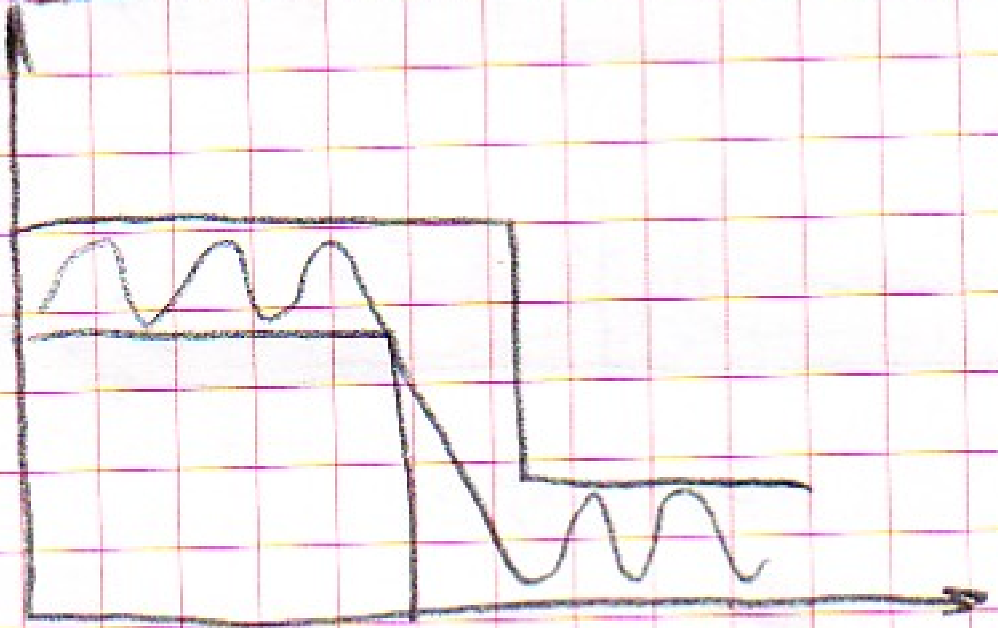
⑥ —||— — áteresztősávban monoton L-szűrő !

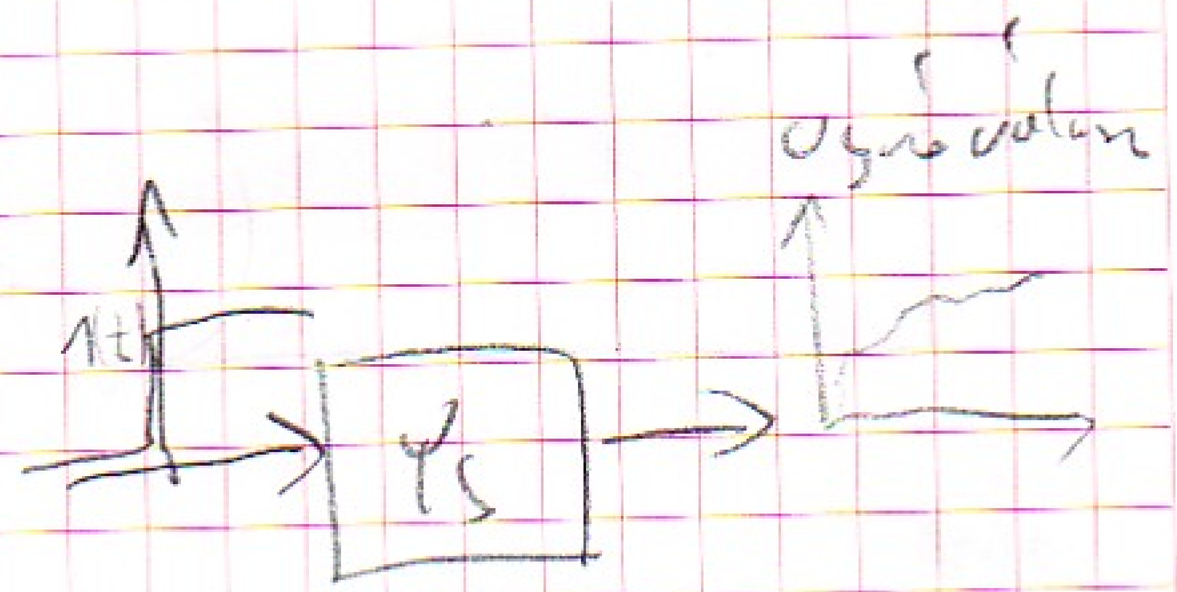
①



③

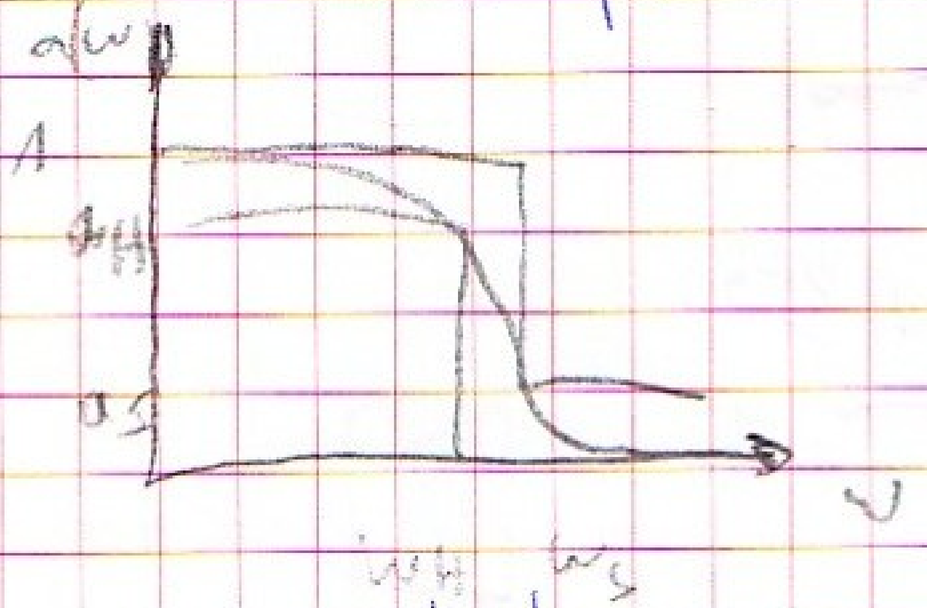






① Butterworth

$$|Y(\omega)| = \frac{1}{\sqrt{1+\omega^{2n}}} \Rightarrow \frac{1}{1+B_1 s + B_2 s^2 + \dots + B_n s^n}$$



tűrésséma

Ω_c Ω_H

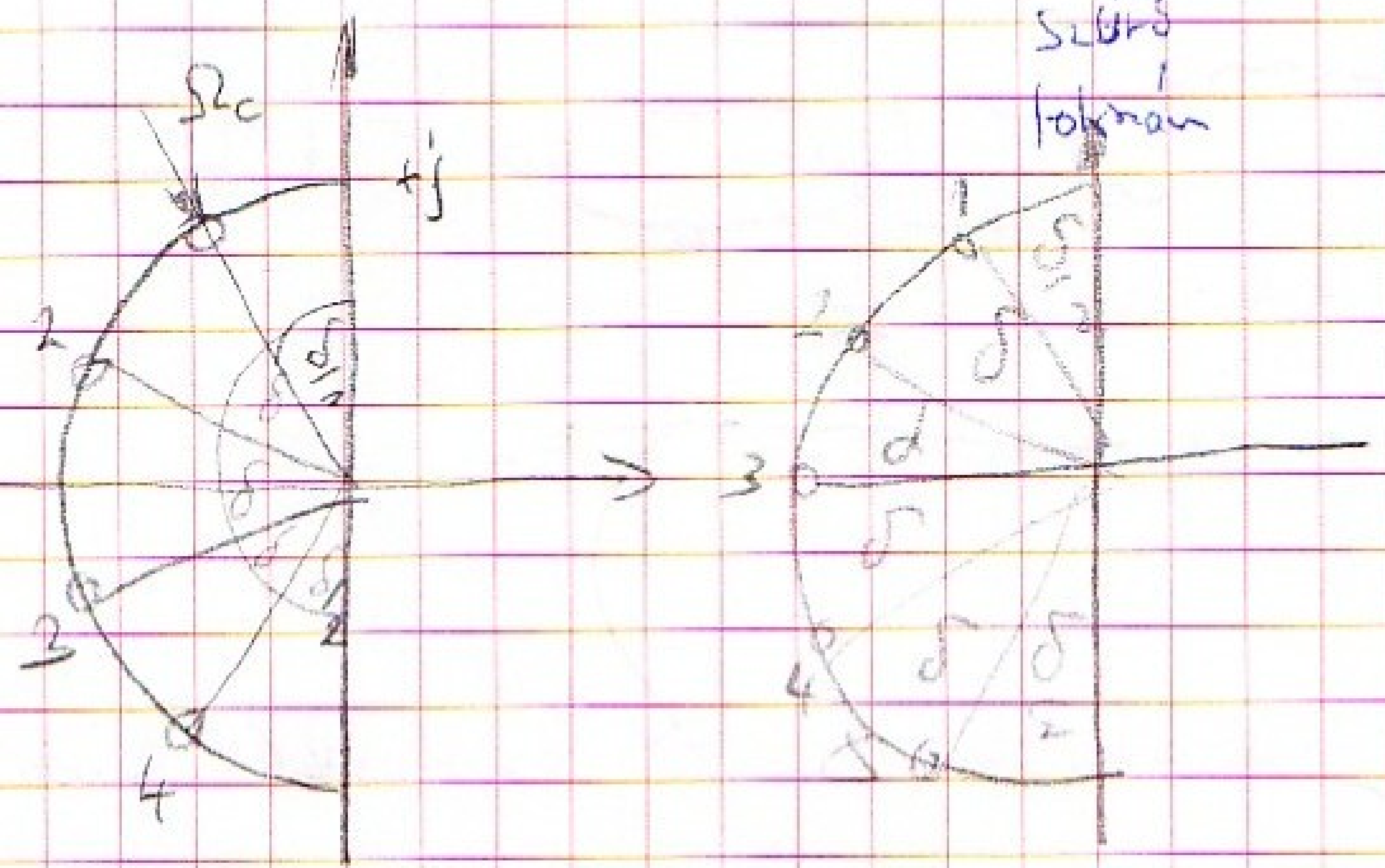
ingadozás paramétere

$$\varepsilon_S = \sqrt{\frac{1}{a_S^2} - 1}$$

$$\varepsilon_H = \sqrt{\frac{1}{a_H^2} - 1}$$

$$\boxed{n \geq \frac{\lg \frac{\varepsilon_S}{\varepsilon_H}}{\lg \frac{\Omega_S}{\Omega_H}}} \, ; \quad \boxed{\Omega_c = \frac{\Omega_H}{\sqrt[n]{\varepsilon_H}}} \, ;$$

szűrő fokszám



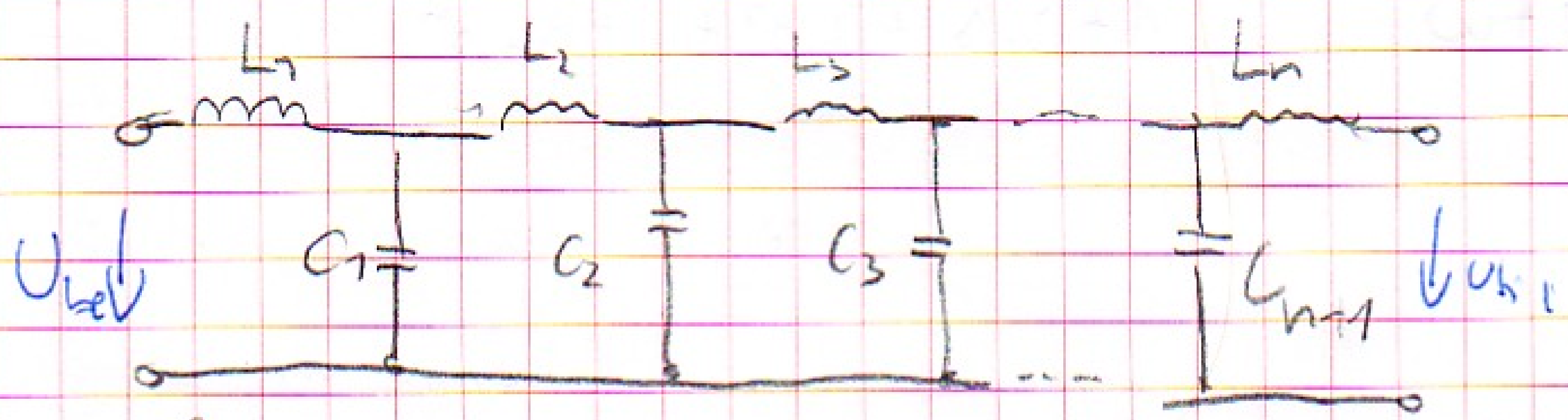
n páros ⇒ 4

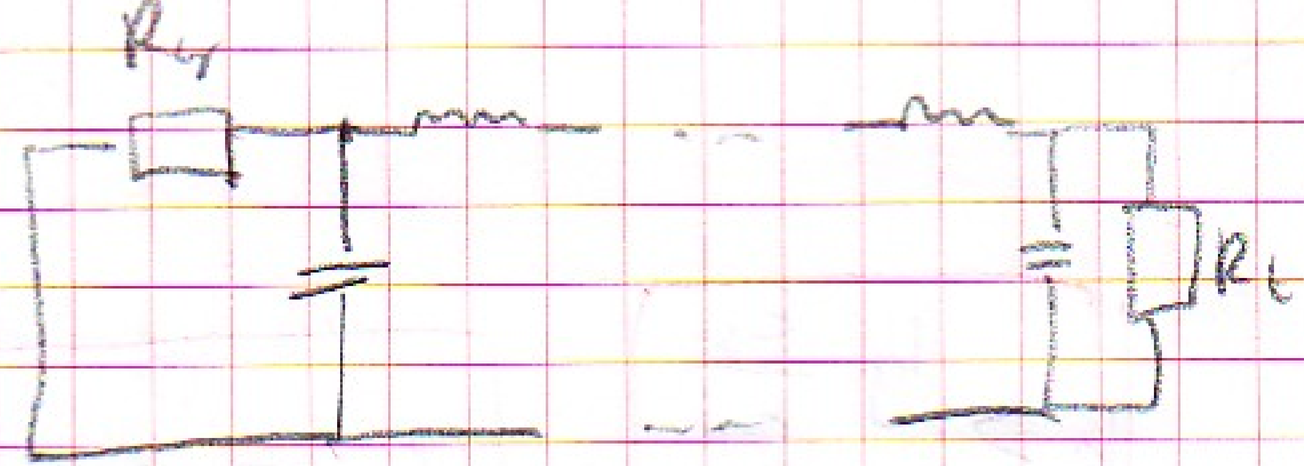
$\delta = 45°$

n ptlan = 5

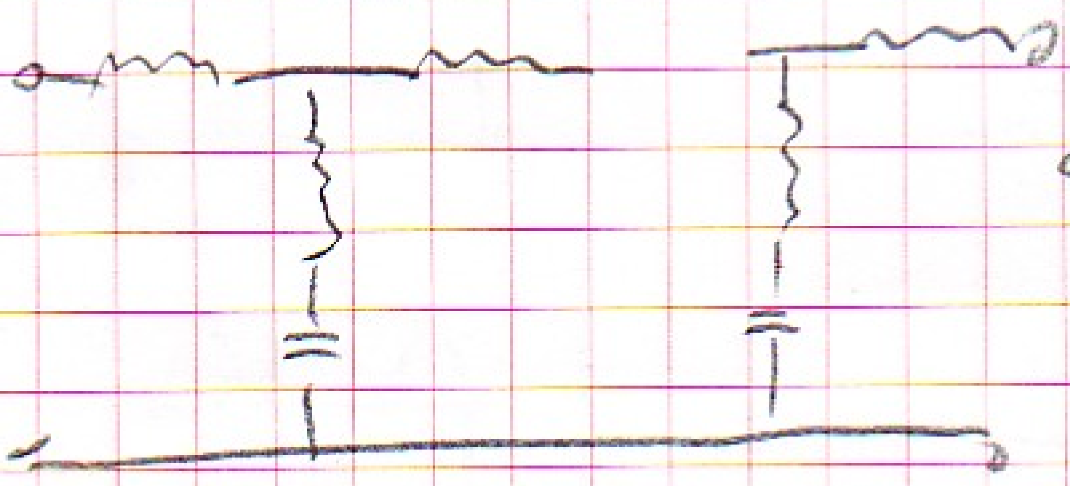
$\delta = 36°$

1 LC-szűrők





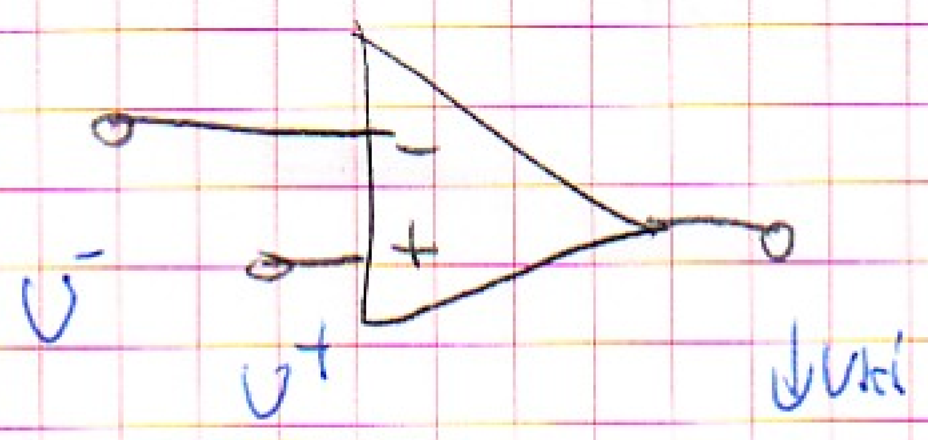
$\boxed{P}$

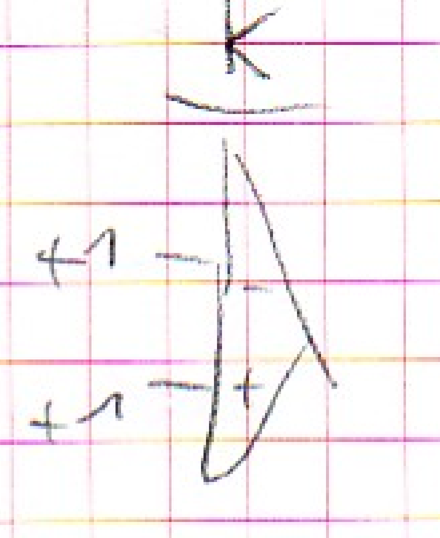


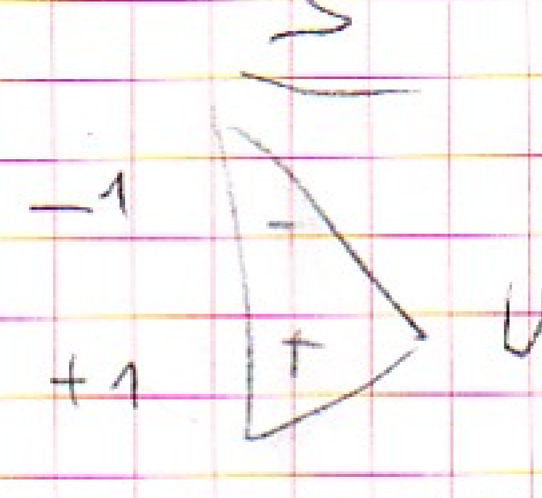
$\boxed{P} + \boxed{Z}$

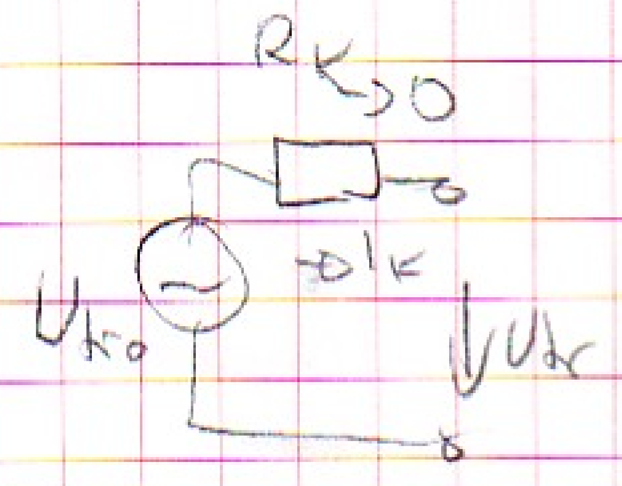
⇒ műv er ⇒ L-let kilea ejti ⇒ csak RC szűrők

ideális mű









$$U_K = \frac{U^+ - U^-}{2}$$

$$U_S = U^+ - U^-$$

$$U_{ki} = A_K \cdot U_K + A_S \cdot U_S$$

$A_K(\omega)$ → $\emptyset$

$A_S(\omega)$ → ∞