# E. Analogică



$$U_i \longrightarrow \boxed{Dig} \longrightarrow U_e$$

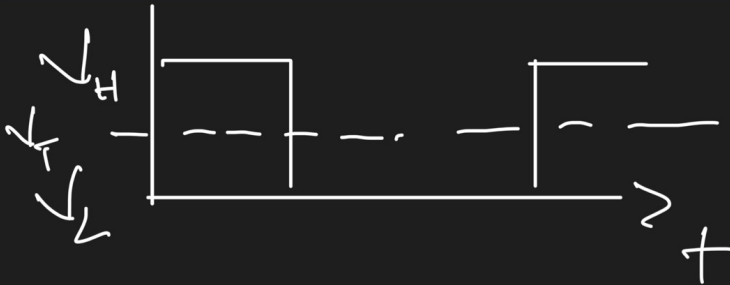## Electronica Numerică

<span style="color:red">Impuls IDEAL</span>



<span style="color:red">↳ threshold (prag)</span>

<span style="color:red">Voltage High $\in (-u \div +u)$</span>

<span style="color:red">Low $\in (-u \div +u)$</span>

<span style="color:red">$\boxed{V_H > V_L}$</span>

<span style="color:red">Practica: $V_H = +U \ e \times (+3 \div +5$</span>

<span style="color:red">$V_L = 0 \checkmark$</span>

$$\begin{cases} < \text{prag} \rightarrow V_L \quad \text{inf.} \\ > \text{prag} \rightarrow V_H \quad \text{sup.} \end{cases}$$

$$\begin{cases} V_H \rightarrow 1 \quad \text{logic} \\ V_L \rightarrow 0 \quad \text{logic} \end{cases}$$

## Circuitele numerice

Dublă natură

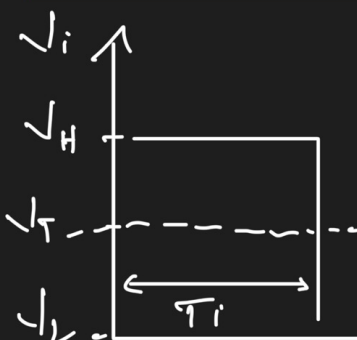Electronica (transistori, diode, rez.)

Logică — DA, NU, Si ← Si-NU, SAU - SAU-NU

## Impuls Ideal (semnal numeric ideal)
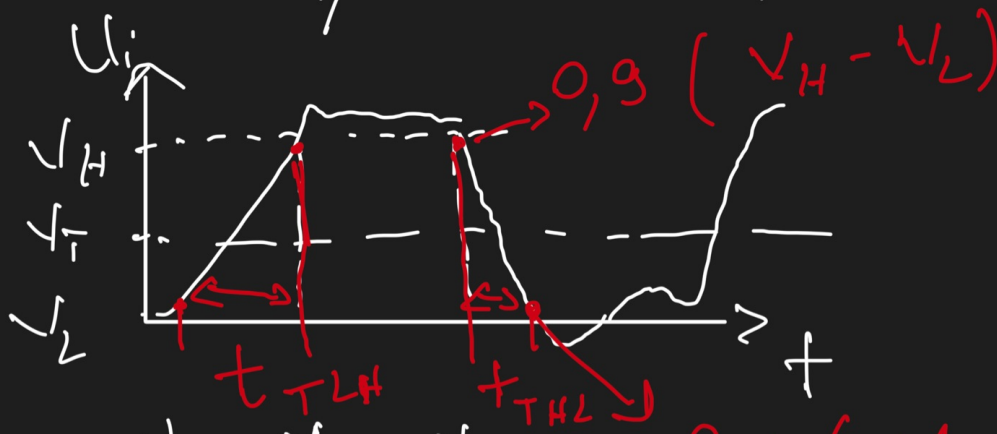
### Parametrii

1) $V_H$, $V_L$        $[V]$

2) $V_T$    ideal    $\dfrac{V_H + V_L}{2} = V_T$    $\{V\}$

3) $T_i$ (durata impuls)     $[s]$

4) $T$ (durata de repetiție) $[s]$ $F = \dfrac{1}{T}$ $[Hz]$

Circuit numeric ideal    $U_e \in [V_H, V_L]$

## Impuls Real



$> 0,9 \ (V_H - V_L)$

$0,1 \ (V_H - V_L)$

$t_{TLH}$    $t_{THL}$

1) $V_H$, $V_L$

2) $V_T$

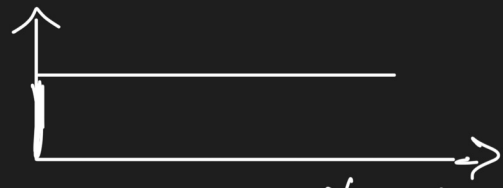3) $T_i$    $\left(\dfrac{V_H + V_L}{2}\right)$     5) $t_{TLH}$ ; $t_{THL}$

4) $T$

# Semnale de bază

**A)** sem. treaptă

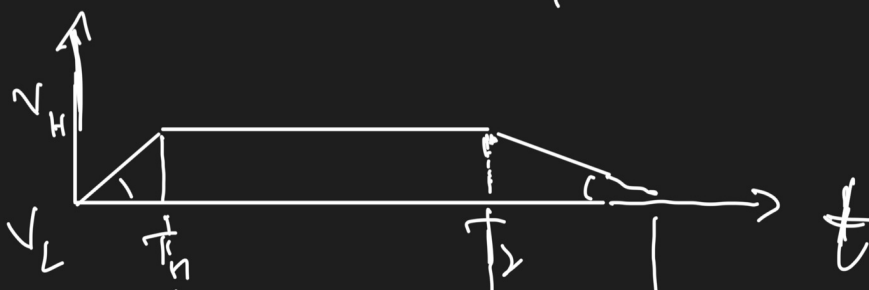$$U_i \in \begin{cases} 0, & t < 0 \\ u_1 & t \geq 0 \end{cases}$$

ex. impulsul este format din sume de sem. treaptă

$V_H$

$V_L$

$U_i$ $T$

$T_i'$

$u_1(t_i)$

$U_{i_3}(t-T)$

$U_{i_2}(t-T_i)$

$-u$
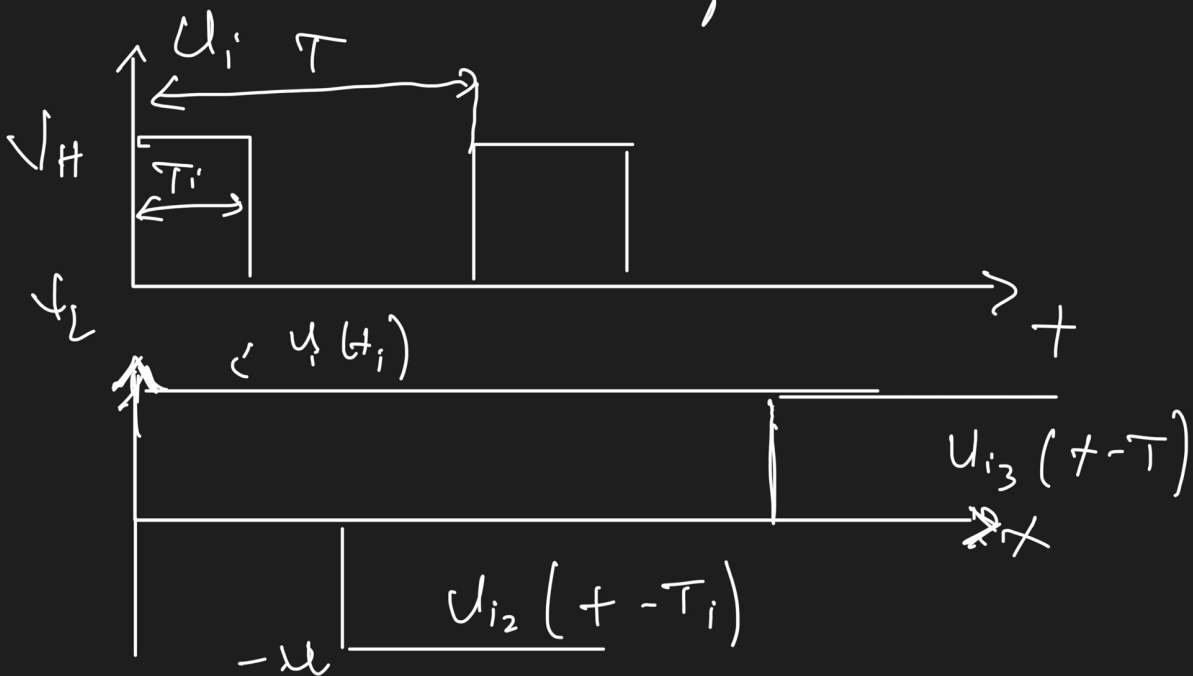
## Sem. liniare variabile

$U_i$

$k$

$t$

$$U_i = \begin{cases} 0, & t < 0 \\ kt, & t \geq 0 \end{cases}$$

$V_H$

$V_L$

$T_1$

$T_2$

$t$

$$U_i(f)$$

$$U_{i_4}\left(t - T_1 - T_2 - T_3\right)$$

$$k_2$$

$$k_2$$

$$k_1$$

$$k_1$$

$$U_{i_2}(t - T_1)$$

$$U_{i_3}\left(t - T_1 - T_2\right)$$

$$-U_H$$

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Sem. exp.

$$U_i$$
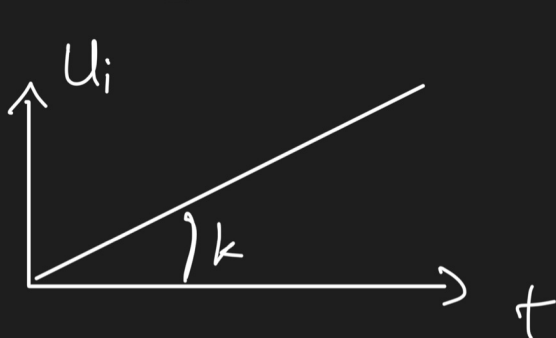
$$U_i \in \begin{cases} 0, & t < 0 \\ u\left(1 - e^{-\frac{t}{6}}\right) \\ 6 - const. \ timp \end{cases}$$

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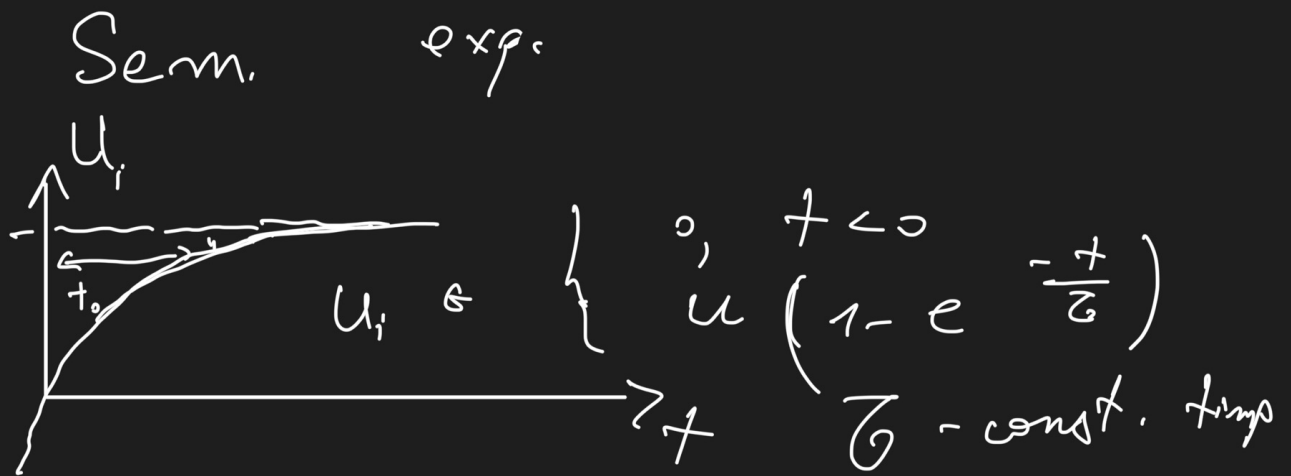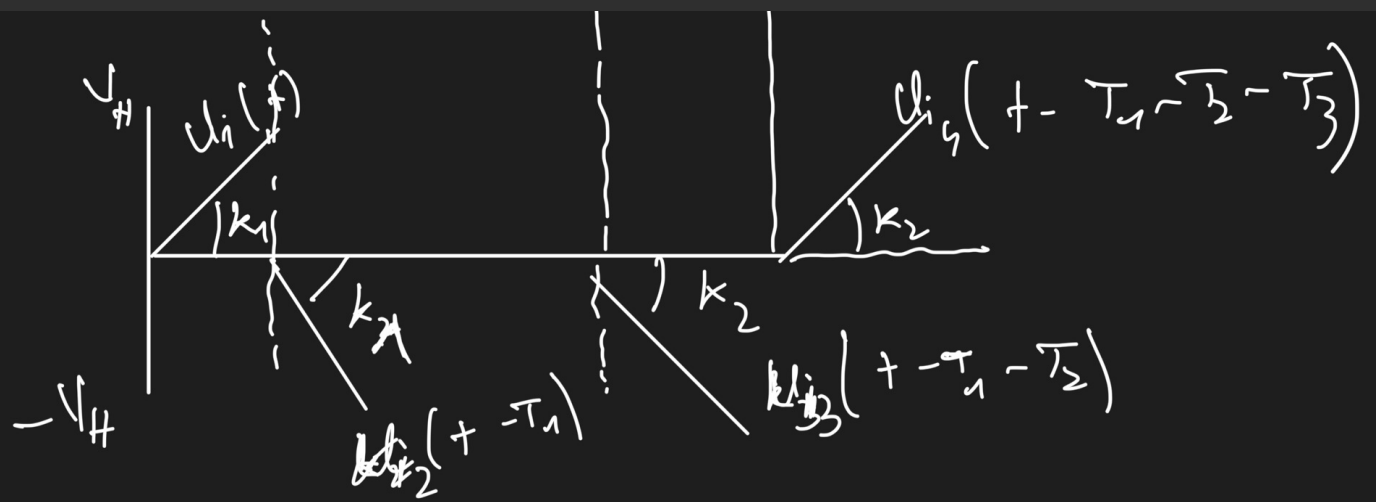
| Analiza chc. numerice |

a) Metode integra – diferentiala
$\longrightarrow$ o singura $6$

b) met. suprapunerii sem
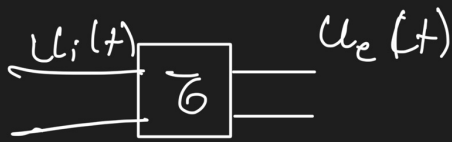
$$\frac{d\,U_e\,(t)}{dt}\,\tau + U_e\,(t) = U_i\,(t)$$

$$U_e\,(t) = U_{e_1}\,(t) + U_{e_2}\,(t)$$

$$U_{e_1}\,(t) = \text{rasp. ec. dif.}$$

① $\dfrac{d\,U_{e_1}(t)}{dt}\,\tau = 0$

$$U_{e_1}\,(t) = A\,e^{-\frac{t}{\tau}}$$

$$U_e\,(t) = U_{e_2}\,(t) + A\,e^{-\frac{t}{\tau}}$$

a) $pt \quad t \to \infty$

$$U_e\,(\infty) = U_{e_2}\,(\infty)$$

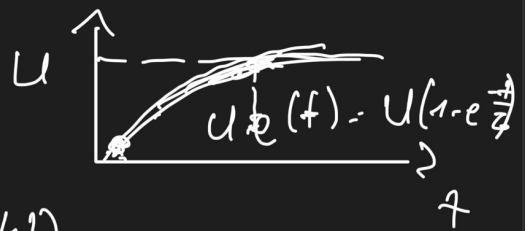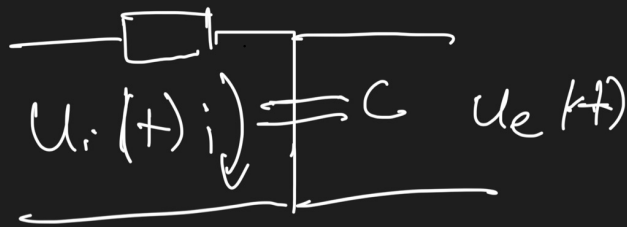$$U_e\,(t) = U_e\,(\infty) + A \cdot e^{-\frac{t}{\tau}}$$

b) $pt \quad t = 0$

$$U_e\,(0) = U_e\,(\infty) + A$$

$$A = U_e\,(0) - U_e\,(\infty)$$

$$U_e\,(t) = U_e\,(\infty) + \left[U_e\,(0) - U_e\,(\infty)\right] \cdot e^{-\frac{t}{\tau}}$$

Fre cincuital



$$U_i(t) \, i \rightleftharpoons C \quad U_e(t)$$

$$u_e(t) = U(1-e^{-\frac{t}{\tau}})$$

$$X_C = \frac{1}{wC}$$

$$w = 2\pi F$$

$$\begin{cases} pt \quad t=0, \quad F=\infty \\ \quad \rightarrow X_C = 0 \\ \quad \rightsquigarrow U_{e_0} = 0 \\ \\ pt \quad t=\infty \quad F=0 \\ \quad X_C = \infty, \quad i=0 \\ \quad U_e(\infty) = U \end{cases}$$

$$t_2 = \frac{t}{2} - t_1$$

$$U_e(t_2) = 0,9 \, U = U_e(\infty) + \left[ U_e(0) - U_e(\infty) \right] e^{-\frac{t}{6}}$$

$$t_2 = 6 \ln \frac{U_e(\infty) - U_e(0)}{U_e(\infty) - U_e(t_2)}$$

$$t_1 = -1t$$

$$t_2 = 6 \ln \frac{U_e(\infty) - U_e(t_1)}{U_e(\infty) - U_e(t_2)}$$

$$= RC \ln \frac{U - 0,1U}{U - 0,9U}$$

$$= RC \ln 9 \simeq 2,3 \, RC$$