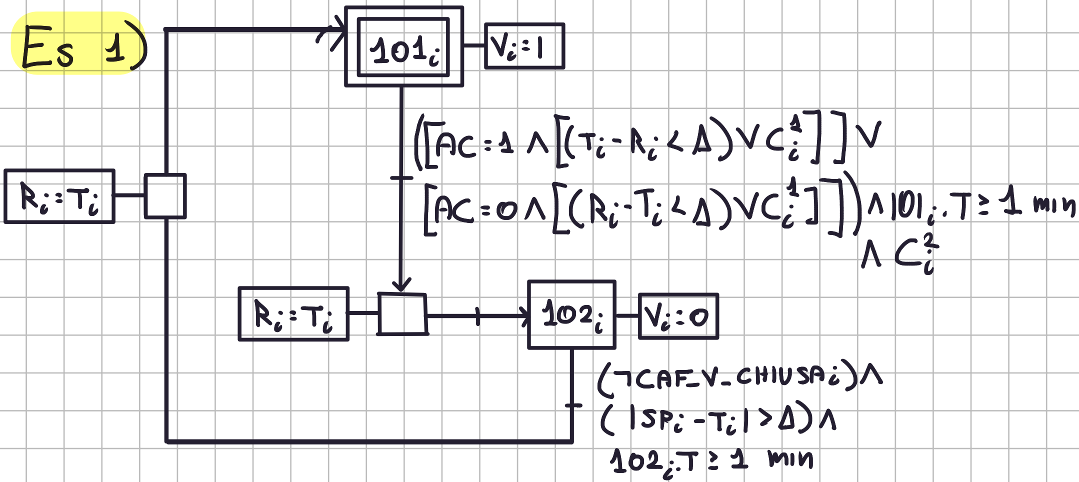
Es 1)



$C_i^1 : |T_i - SP_i| \leq \Delta$

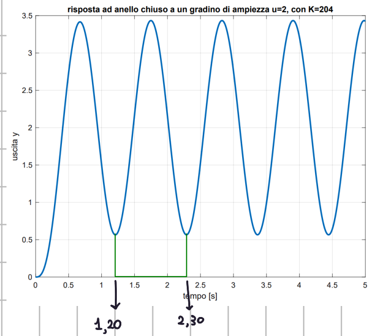
$C_i^2 : \exists j (j \neq i \wedge V_j = 1)$

↑ Almeno un'altra valvola e' aperta

$CAF\_V\_CHIUSA_i =$
$(AC = 0 \wedge R_i - T_i = \Delta) \vee$
$(AC = 1 \wedge T_i - R_i = \Delta)$

Es 2)

Considero il periodo delle oscillazioni della Figura 2:



$P_c = 2.3 - 1.2 = 1.1$ sec
$K = 204$

Applicando il 2° metodo Z-N si trovano i seguenti guadagni per un controllore PID

$K_P = 0.6 \cdot 204 = 122.4$ $\quad K_I = \frac{1}{2} \cdot 1.1 = 0.55$ $\quad K_D = \frac{1}{8} \cdot 1.1 = 0.137$

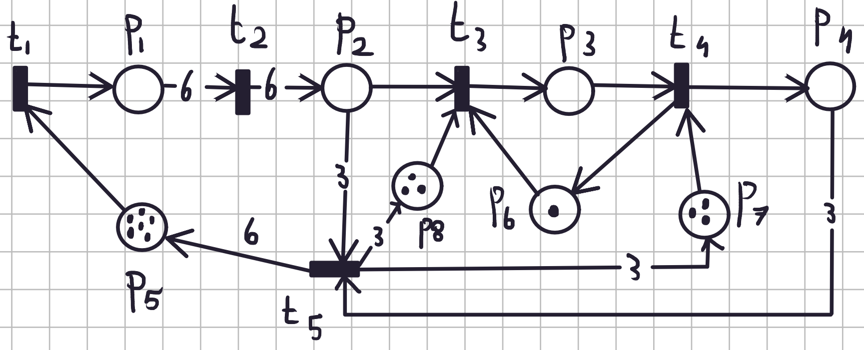
Per un controllo PI: $\quad K_P = 0.45 \cdot 204 = 91.8$ $\quad K_I = 0.98$

Voglio analizzare la risposta impulsiva per stimare i poli di $P(s)$.

$$P(s) = \frac{K'}{(s-p_1)(s-p_2)(s-p_3)} \quad \begin{cases} p_1 ? \\ p_2 ? \\ p_3 ? \end{cases}$$

sinceramente non so procedere

Es3)



p_5, p_2, p_1 rappresentano il buffer B_0
p_3 rappresenta M_1 e p_4 B_1
quando ci sono 3 pezzi su p_2 e 3 pezzi su p_4, t_5 che rappresenta M_2 scatta

Studio gli invarianti P e T calcolando $Ker(C)$ e $Ker(C^T)$

$$C = \begin{bmatrix} 1 & -6 & 0 & 0 & 0 \\ 0 & 6 & -1 & 0 & -3 \\ 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 1 & -3 \\ -1 & 0 & 0 & 0 & 6 \\ 0 & 0 & -1 & 1 & 0 \\ 0 & 0 & 0 & -1 & 3 \\ 0 & 0 & -1 & 0 & 3 \end{bmatrix} \qquad C^T = \begin{bmatrix} 1 & 0 & 0 & 0 & -1 & 0 & 0 & 0 \\ -6 & 6 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 1 & 0 & 0 & -1 & 0 & -1 \\ 0 & 0 & -1 & 1 & 0 & 1 & -1 & 0 \\ 0 & -3 & 0 & -3 & 6 & 0 & -3 & 3 \end{bmatrix} \qquad x_0 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 6 \\ 1 \\ 3 \\ 3 \end{bmatrix}$$

$Ker(C) : \{ [6x, x, 3x, 3x, x]^T,\ x \in \mathbb{R} \} \Rightarrow$ T inv. canonico : $[6, 1, 3, 3, 1]$

$Ker(C^T) : \{ [a, a, a+b+d, a+c+d, a, b, c, d]^T,\ a, b, c, d \in \mathbb{R} \}$

P invarianti canonici :

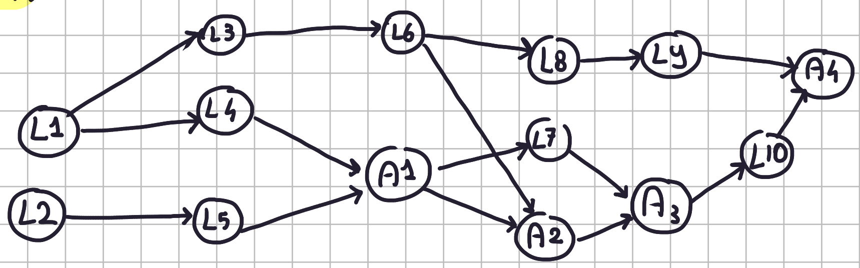
$\{ [1\,1\,1\,1\,1\,0\,0\,0]^T, [0\,0\,1\,0\,0\,1\,0\,0]^T, [0\,0\,0\,1\,0\,0\,1\,0]^T, [0\,0\,1\,1\,0\,0\,0\,1]^T \}$

L'albero e' semplice perche' solo una transiz. alla volta e' attiva.

• [0 0 0 0 6 1 3 3]
↓ t_1
• [1 0 0 0 5 1 3 3]
↓ t_1
• [2 0 0 0 4 1 3 3]
↓ t_1
• [3 0 0 0 3 1 3 3]
↓ t_1
• [4 0 0 0 2 1 3 3]
↓ t_1
• [5 0 0 0 1 1 3 3]
↓ t_1
• [6 0 0 0 0 1 3 3]
↓ t_2
• [0 6 0 0 0 1 3 3]
↓ t_3
• [0 5 1 0 0 0 0 3 2]
↓ t_4
• [0 5 0 1 0 0 1 2 2]
↓ t_3
• [0 4 1 1 0 0 0 2 1] $\xrightarrow{t_4}$ • [0 4 0 2 0 0 1 1 1]
↑ t_3
[0 3 1 2 0 0 0 1 0]
↑ t_4
[0 3 0 3 0 0 1 0 0]
t_5 → [0 0 0 0 6 1 3 3]

Variante :

Es 4)



Applico l'algoritmo RPWT

tasso di prod: $140 \frac{p}{d} = 5,83 \frac{p}{h}$

$= 0.09722 \frac{p}{min}$

$CMT = p^{-1} = 10,285$ minuti

numero minimo macchine $= \frac{63}{10.285}$

operazioni	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	A_1	A_2	A_3	A_4
durata [in minuti]	5	3	4	3	6	5	2	5	1	4	8	7	5	5
precedenti immediate	–	–	L_1	L_1	L_2	L_3	A_1	L_6	L_8	A_3	L_4 L_5	L_6 A_1	L_7 A_2	L_9 L_{10}
PW_i	52	40	41	34	37	37	16	11	6	9	31	21	14	5

Ordino secondo PW_i: $L_1 \to L_3 \to L_2 \to L_5 \to L_6 \to L_4 \to A_1 \to A_2 \to L_7 \to A_3 \to L_8 \to L_{10} \to L_9 \to A_4$

M1 : L_1 L_3 sb : 1

M2 : L_2 L_5 sb : 1

M3 L_6 L_4 sb : 2

M4 A_1 sb : 2

M5 A_2 L7 sb : 1

M6 A_3 L8 sb : 0

M7 L9 A4 sb : 4

sb medio $= \frac{12}{7} = 1.714 = 16,67\ \%$