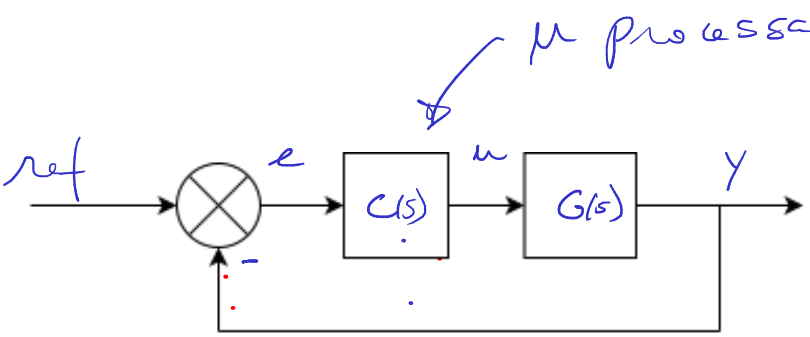
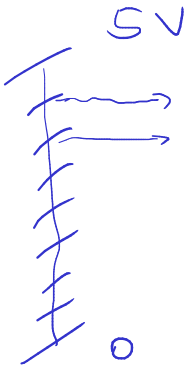


tempo contínuo { analógico
eq. dif. ord.
func. transf. Laplace
amplitude contínua

$U(s) = C(s)E(s)$ $\quad C(s) = K_p + \frac{K_i}{s} + K_D s$

Digital:



4 bits → 2^4 níveis.

0 1 2 3 ... 15

0V $\quad \frac{5}{16}$V $\quad 2 \cdot \frac{5}{16}$

No programa:

input = Analog Read (A0)

Arduino → 10 bits → 2^{10} e 1024 níveis.

0 ~ 1023

0 → 0V

1023 → 5V

1 → $\frac{5}{1024} \approx 5$mV

Clock: discretização do tempo.

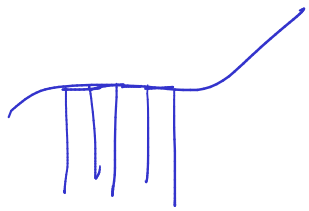
0 1º ciclo

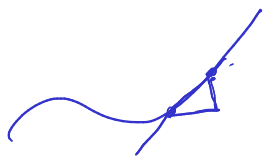
1 ms. = período de amostragem.

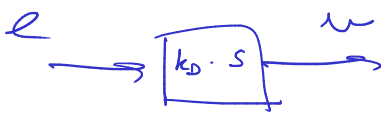
$e_c \; += \; e \cdot \Delta t$

$e_c = e_c + \overset{0,5}{e \cdot \Delta t}$

e_c	0	0,5	1	1.5	...		
n	1	2	3	4	5	6	...





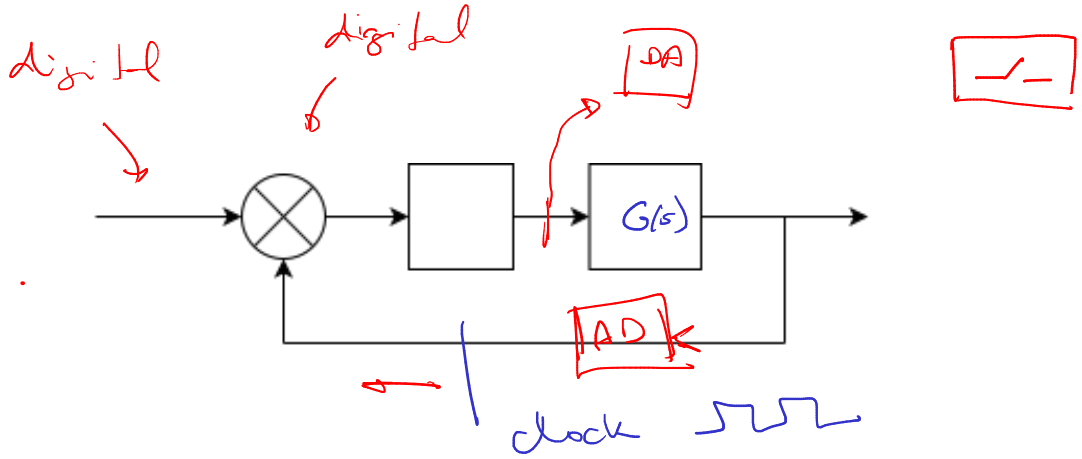


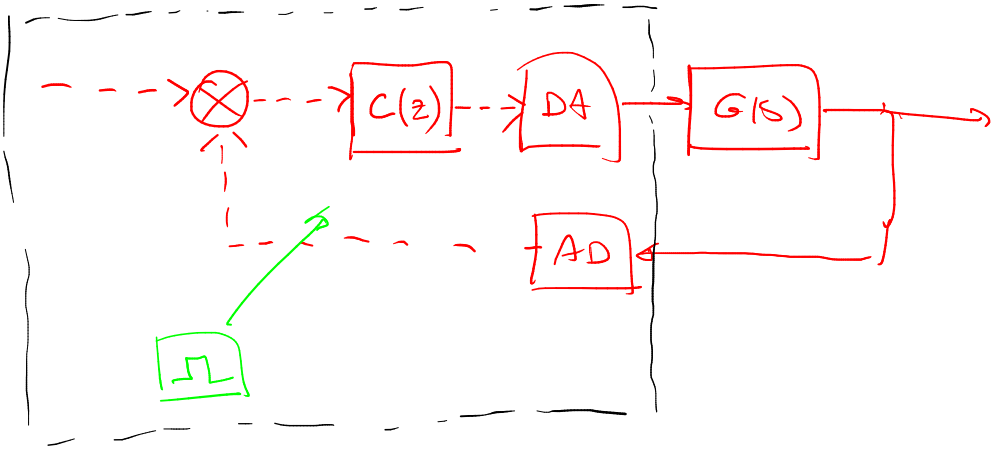
$s = j\omega$

$=$ $U(\omega) = E(\omega) \cdot j\omega$

$|U(\omega)| = |E(\omega)| \cdot \omega \uparrow$

$\rightarrow \frac{k_D j\omega}{j\omega T + 1}$


digital
digital
DA
G(s)
AD
clock


C(z)
DA
G(s)
AD