

$$G(s) = \frac{1}{(s+1)^3}$$

PID

$$1) \text{PID}(s) = K_p + \frac{K_i}{s} + \underbrace{K_d \cdot s}$$

$$2) \text{PID}(s) = K_p + \frac{K_i}{s} + \frac{K_d \cdot s}{1 + \frac{K_d \cdot s}{N}}$$

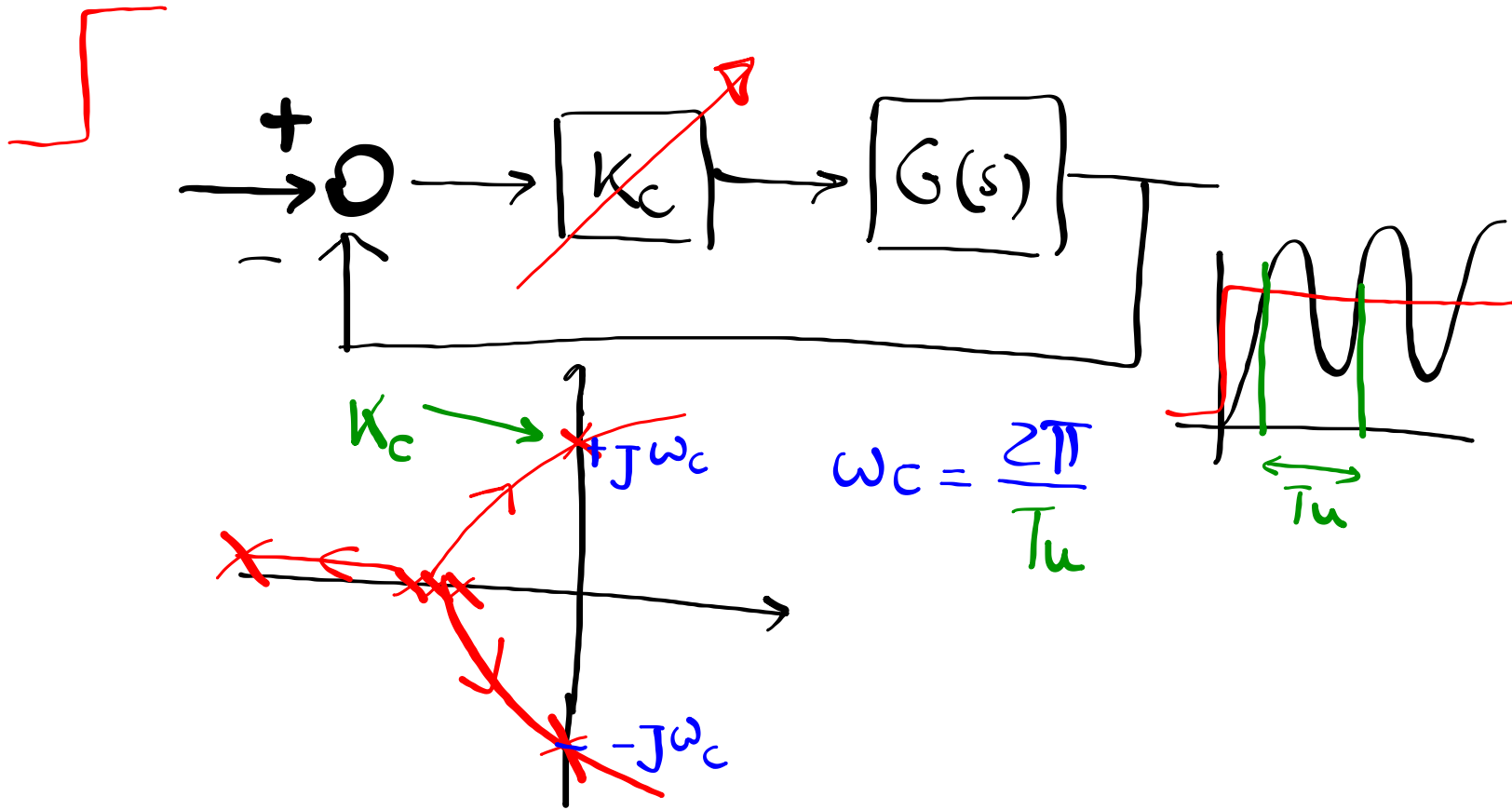
$N \in [10 \div 100]$

$N \rightarrow \infty$

Annotations: A red arrow labeled 'I' points to the $\frac{K_i}{s}$ term. A green arrow points from the $K_d \cdot s$ term in the numerator to the $K_d \cdot s$ term in the denominator. A red arrow points down from the $K_d \cdot s$ term in the first equation to the top of the box.

Ziegler - Nichols

$$\left\{ \begin{array}{l} K_p = 0.6 \cdot K_c \\ K_i = 2 K_p / T_u \\ K_d = K_p \cdot T_u / 8 \end{array} \right.$$



Vantaggi del PID

- Riduce o elimina l'errore a regime (I) $1/s$
- Riduce la sovra-elongazione (D)

PID Discret

PID Continuo

$$K_p + K_i \cdot \frac{1}{s} +$$

EA

$$s = \frac{z-1}{T}$$

$$\frac{K_d s}{1 + K_d \cdot s/N}$$

$$1 + K_d \cdot s/N$$

EI

$$s = \frac{1-z^{-1}}{T}$$

PID discret