u -> input
x -> state
y -> output

$u \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{bmatrix}$ x - -

MM - isi
SS - MM

$$\begin{cases} \dot{x}(t) = Ax(t) + b\,u(t) & \text{-> state eq} \\ y(t) = c^T x(t) + d\,u(t) & \text{-> output eq.} \end{cases}$$

IO - MM input -> output

$$\sum_{\nu=0}^{n} a_\nu\, y^{(\nu)}(t) = \sum_{\mu=0}^{m} b_\mu\, u^{(\mu)}(t)$$

$m \leq n$

-> reprezentare funcțională a unui sistem proces

Clasificarea

→ continuu (s)

→ discret (z)

Sistem Dinamic în Timp Continuu

$$\dot{x}(t) = f(t, x(t), u(t)) \quad \to \text{state}$$

$$y(t) = f(t, x(t), u(t)) \quad \to \text{output}$$

$x(t_0)$ specificat

$x(t) \to$ starea $\qquad (t, x(t)) \to$ faza sistemului

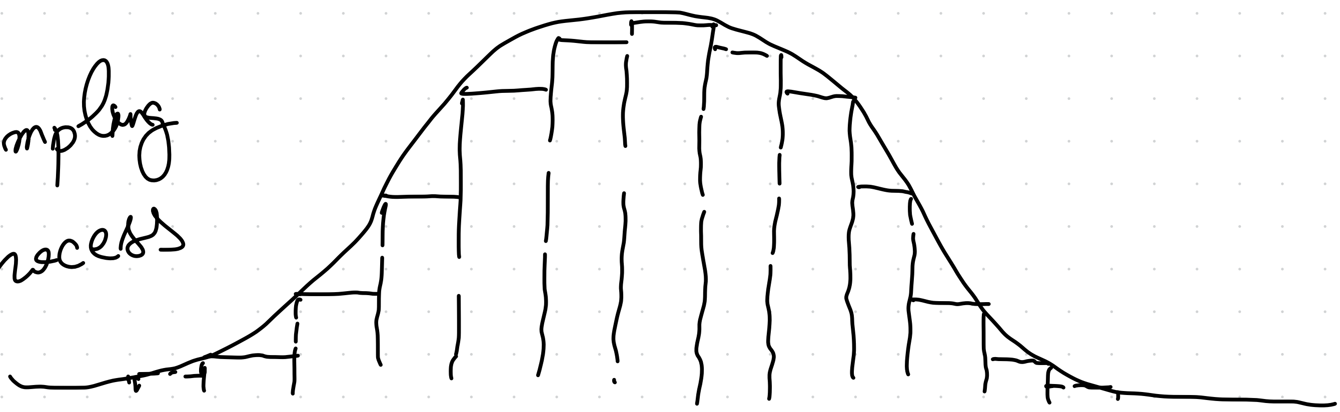
Sisteme multivariabile $\qquad$ Multi Input Multi Out

Sistem în timp discret

t_k (la momentul T_e / T_s) → sampling period

$u(t_k) = u_k \qquad y(t_k) = y_k$ → samples

Sampling Process



$$x(k+1) = f(k, x(k), u(k)) \rightarrow \text{state}$$
$$y(k) = g(k, x(k), u(k)) \rightarrow \text{output}$$

$k \in \mathbb{Z}(\mathbb{N})$ nr. de momente de timp discret
$$t_k = k T_e$$

$$\boxed{k =: t}$$

(Proportional Integrator)

Controller PI
$$u(t) = k_p e(t) + k_i \int_0^t e(\tau) d\tau$$

$$e(t) = y_r(t) - y(t)$$ eroarea de control

parametri $\begin{cases} k_p \rightarrow \text{proportional gain} \\ k_i \rightarrow \text{integral gain} \end{cases}$