# Wektor stanu

$$m\frac{d^2y}{dt^2}+b\frac{dy}{dt}+ky=b\frac{du}{dt}+k\cdot u$$

podstawienie
$f(t)=b\frac{du}{dt}+ku$

↳ ~~wyjście~~ wejście

$$m\frac{d^2y}{dt}+b\frac{dy}{dt}+ky=f(t)$$

$\frac{dy}{dt}=\vartheta$ zmienne stanu $\cancel{[x_1,x_2]=[y,\vartheta]}$ $x_1=y$, $x_2=\vartheta$

wektor stanu $\mathbf{x}=[x_1,x_2]=[y,\vartheta]$

$$\begin{cases}\frac{dy}{dt}=\vartheta\\ m\frac{d\vartheta}{dt}+b\cdot\vartheta+ky=x\end{cases}$$

$$\begin{cases}\frac{dy}{dt}=\vartheta\\ \frac{d\vartheta}{dt}=\frac{1}{m}f(t)-b\cdot\vartheta-ky\end{cases}$$

$$\begin{cases}\frac{dy}{dt}=0\cdot y+1\cdot\vartheta+0\cdot f(t)\\ \frac{d\vartheta}{dt}=-\frac{k}{m}y-\frac{b}{m}\vartheta-\frac{1}{m}f(t)\end{cases}$$

Zapis macierzowy

$$\begin{bmatrix}\frac{dy}{dt}\\ \frac{d\vartheta}{dt}\end{bmatrix}=\underbrace{\frac{d}{dt}\begin{bmatrix}y\\ \vartheta\end{bmatrix}}_{\dot{x}}=\underbrace{\begin{bmatrix}0 & 1\\ -\frac{k}{m} & -\frac{b}{m}\end{bmatrix}}_{A}\cdot\underbrace{\begin{bmatrix}y\\ \vartheta\end{bmatrix}}_{x}+\underbrace{\begin{bmatrix}0\\ -\frac{1}{m}\end{bmatrix}}_{B}\cdot f(t)$$

$$\dot{x}=A\cdot x+B\cdot f(t)$$