

Materi yang lahir:

* Solusi PERS. DIFF order pertama
dengan: METODE NUMERIK:

* Order Pertama
* Order Kedua

* Solusi PERS. DIFF order tinggi > 1

n buah
pers.
diff
order
pert

n buah Pers-Diff order pertama

$$\frac{dx_1(t)}{dt} = x_2$$

$$\frac{dx_2(t)}{dt} = x_3$$

$$\frac{dx_n(t)}{dt} = -\frac{a_1}{a_n} x_1 - \frac{a_2}{a_n} x_2 - \dots - \frac{a_{n-1}}{a_n} x_n + \frac{1}{a_n} u(t)$$

↳ matriks

n buah
pers diff
order pertama

$$\frac{dx(t)}{dt} = -2x(t) \quad \int x = x \int \frac{dx}{x} = \int \frac{1}{x} dx = \ln x$$

$$\int \frac{dx(t)}{x(t)} = \int -2 dt = -2 \int dt = -2t + K$$

$$\ln[x(t)] = -2t + K$$

$$x(t) = e^{-2t + K} = e^K e^{-2t}$$

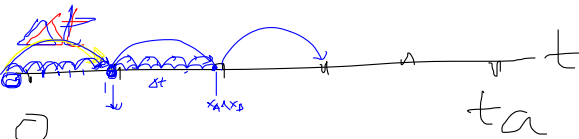
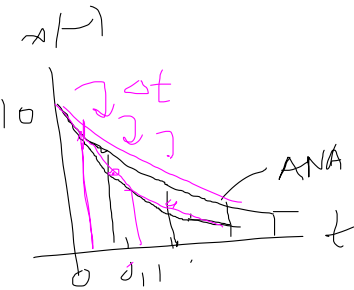
$$x(t) = A e^{-2t} \quad \leftarrow \text{solusi umum}$$

$$x(0) = 10 \rightarrow 10 = A e^{-2(0)} = A$$

$$\text{Solusi: } x(t) = 10 e^{-2t} \quad \text{analitik exact}$$

$$\text{ANA: } x(t) \text{ ANA}$$

$$\begin{array}{c} 0 \\ 0,1 \\ 0,2 \\ \vdots \end{array} \quad \begin{array}{c} 10 \\ 10 e^{-0,2} = 8,18730 \\ 10 e^{-0,4} = 6,70320 \\ \vdots \end{array}$$



$$\text{Pers. Diff. order ke-n: } a_n \frac{d^n x(t)}{dt^n} + a_{n-1} \frac{d^{n-1} x(t)}{dt^{n-1}} + a_{n-2} \frac{d^{n-2} x(t)}{dt^{n-2}} + \dots + a_1 \frac{dx(t)}{dt} + a_0 x(t) = u(t)$$

misal n buah Pers. diff order pertama:

$$\text{Misalkan } x(t) = x_1 \rightarrow \frac{dx_1(t)}{dt} = \frac{dx_1}{dt} = x_2$$

$$\frac{dx_1(t)}{dt} = x_2 \rightarrow \frac{d^2 x_1(t)}{dt^2} = \frac{dx_2}{dt} = x_3$$

$$\frac{d^2 x_1(t)}{dt^2} = x_3 \rightarrow \frac{d^3 x_1(t)}{dt^3} = \frac{dx_3}{dt} = x_4$$

$$\vdots$$

$$\frac{d^{n-1} x_1(t)}{dt^{n-1}} = x_n \rightarrow \frac{d^n x_1(t)}{dt^n} = \frac{dx_n}{dt}$$

$$\frac{d^n x(t)}{dt^n} = -\frac{a_0}{a_n} x(t) - \frac{a_1}{a_n} \frac{dx(t)}{dt} - \frac{a_2}{a_n} \frac{d^2 x(t)}{dt^2} - \dots - \frac{a_{n-1}}{a_n} \frac{d^{n-1} x(t)}{dt^{n-1}} + \frac{1}{a_n} u(t)$$

$$\frac{dx_n}{dt} = -\frac{a_0}{a_n} x_1 - \frac{a_1}{a_n} x_2 - \frac{a_2}{a_n} x_3 - \dots - \frac{a_{n-1}}{a_n} x_n + \frac{1}{a_n} u(t)$$

Numerik
order kedua

x(t)	NUM	ERROR
10		0
8,000		0,1873 ←
6,4		0,3032 ←
...		

t	x(t) NUM	ERROR
0	10	0
0,1	8,2	0,01370
0,2	6,724	0,00000
...		