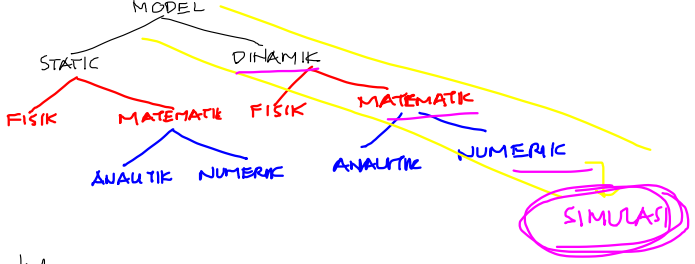
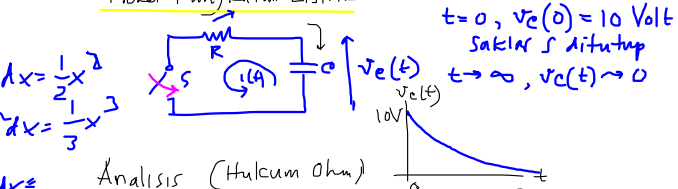


Project 1

VERIFIKASI SIMULINK

Kasus : Pelepasan muatan Kapasitor melalui Resistor

Model Rangkaian Listrik



$t=0$, $v_c(0)=10$ Volt
Saklar S ditutup
$t \to \infty$, $v_c(t) \to 0$

$\int x\,dx = \frac{1}{2}x^2$

$\int x^2\,dx = \frac{1}{3}x^3$

$\int x^{-2}\,dx = -x^{-1}$

Analisis (Hukum Ohm)

(1) $i(t) = -C\frac{dv_c(t)}{dt}$

(2) $v_c(t) = Ri(t) \rightarrow i(t) = \frac{v_c(t)}{R}$

$\frac{v_c(t)}{R} = -C\frac{dv_c(t)}{dt}$

Pers. Diff $\frac{dv_c(t)}{dt} = -\frac{1}{RC}v_c(t)$, $v_c(0) = 10$ Volt

$\int \frac{dx}{x} = \ln x$

$\int \frac{dv_c(t)}{v_c(t)} = \int -\left(\frac{1}{RC}\right)dt = -\frac{1}{RC}\int dt = -\frac{t}{RC} + K$

$\int x^{-1}\,dx = \ln x$

$\ln[v_c(t)] = -\frac{t}{RC} + K$

$e^{\log x} = a$

$x = e^a$

$e^{\log[v_c(t)]} = -\frac{t}{RC} + K$

$v_c(t) = e^{\left[-\frac{t}{RC}+K\right]} = e^K e^{-\frac{t}{RC}} = Ae^{-t/RC}$

$t=0 \rightarrow v_c(0) = Ae^0 = A = 10$

Solusi analitik $\boxed{v_c(t) = 10e^{-t/RC}}$ ⟸ exact!

relative 10^{-3} toleransi

t	$v_c(t)$ ANA	$v_c(t)$ SIM	Error

check : (1) $t=0 \rightarrow v_c(0) = 10e^0 = 10$ ✓

$t=\infty \rightarrow v_c(\infty) = 10e^{-\infty} \approx 0$

(2) $\frac{dv_c(t)}{dt} = (-10)\left(\frac{1}{RC}\right)e^{-t/RC}$

$= -\frac{1}{RC}10e^{-t/RC}$

$= -\frac{1}{RC}v_c(t)$ ✓