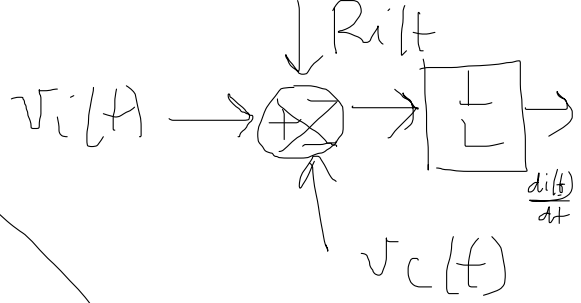
$$\frac{di(t)}{dt} = \frac{1}{L}\left(v_i(t) - v_c(t) - Ri(t)\right)$$

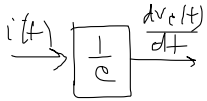
$$\frac{dv_c(t)}{dt} = \frac{1}{C} i(t)$$



* SIMULINK

Hukum Ohm : * $v_i(t) - v_c(t) = Ri(t) + L\frac{di(t)}{dt}$

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



$$\int \frac{di(t)}{dt}\,dt = \int di(t) = i(t)$$

$$\int \frac{dv_c(t)}{dt}\,dt = \int dv_c(t) = v_c(t)$$

$$V_c(s) = \frac{V}{s(LCs^2 + RCs + 1)}$$

$$v_c(t) = \mathcal{L}^{-1}\frac{V}{s(LCs^2 + RCs + 1)}$$ (lihat Fable)

$$I_c(s) = \frac{V_c(s)}{Z_c} = \frac{V/C}{LCs^2 + RCs + 1}$$

$$i_c(t) = \mathcal{L}^{-1} I_c(s)$$ (lihat Fable)

PERANCANGAN SISTEM KENDALI 2013

Project Course → TIDAK ADA UJIAN

SIMULINK @MATLAB

SKRIPSI

- Ujian Akhir (tidak)
- Seminar
- Lampiran Format Journal

PERANCANGAN ← analisis

sistem: DIGITAL | KENDALI | ELEKTRONIK

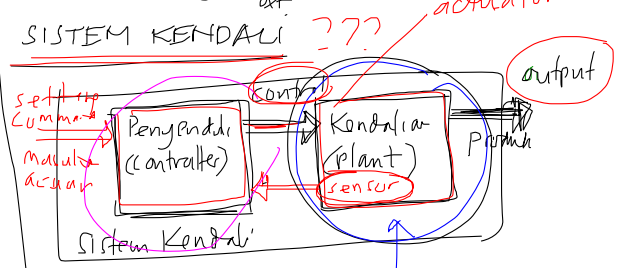
Dasar Komputer, Dasar pemograman, Rangkaian Logika | Dasar Sistem Kontrol | Dasar Elektronika

Persiapan:

* Mencari MITRA (utk yang ingin berkarya berpasangan)
* Akses MATLAB → Simulink

Next project VERIFIKASI SIMULINK

SISTEM KENDALI ???



"designed" | "given"

"MODEL" | "MODEL"

"SIMULINK"

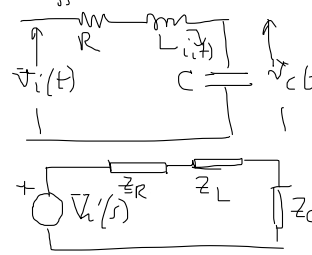
implementasi

Project 1 Verifikasi Simulink

→ toleransi

* ANALITIK

Menggunakan konsep impedansi

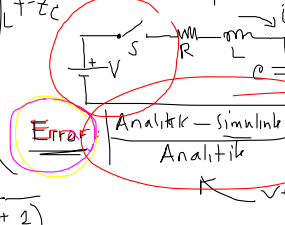


$$G(s) = \frac{V_c(s)}{V_i(s)} = \frac{Z_c}{Z_R + Z_L + Z_c}$$

$$V_c(s) = \frac{Z_c V_i(s)}{Z_R + Z_L + Z_c} = \frac{V_{cs} \cdot \frac{V}{s}}{R + Ls + \frac{1}{Cs}} = \frac{V}{s(LCs^2 + RCs + 1)}$$

* Rangkaian RLC seri

Pemuatan Kapasitor



Error | Analitik − Simulink / Analitik | ×100%

verifikasi

Saklar S ditutup pada $t = 0$, $v_c(0) = \emptyset$

Tentukan $v_c(t)$ dan $i(t)$.

* ANALITIK → exact

* SIMULINK

* Dengan menggunakan spredd-sheet, cari error untuk 3 (tiga) nilai toleransi yang berbeda, 10^{-3}, 10^{-4}, 10^{-5}, — pada simulink

* Carilah solusi ANALITIK untuk $v_c(t)$ dan $i(t)$

* Perbesar dan perkecil nilai R sehingga ada ketiga kasus nilai ξ →
  * $\xi > 1$
  * $\xi = 1$
  * $0 < \xi < 1$

TABEL TIDAK DIKUMPUL → g tabel PENGAMATAN

Tugas I Verifikasi SIMULINK
* Ambil tgl lahir dan salah seorang
  TT-BB-19HH V = 12 Volt
  C = 19HH nF = 19HH * 10^{-6} F
  L = BB Henry
  R = TT Ohm

Tabel Laplace:

$$\mathcal{L}^{-1}\left\{\frac{K}{s(s^2+2\xi\omega_n s+\omega_n^2)}\right\}$$

$v_c(t)$ →
* $\xi > 1 \rightarrow \mathcal{L}^{-1}\dfrac{K}{s(s+a)(s+b)}$
* $\xi = 1 \rightarrow \mathcal{L}^{-1}\dfrac{K}{s(s+\omega_n)^2} \rightarrow \mathcal{L}^{-1}\dfrac{K}{s(s+a)^2}$
* $0 < \xi < 1 \rightarrow \mathcal{L}^{-1}\dfrac{K}{s(s^2+2\xi\omega_n s+\omega_n^2)}$

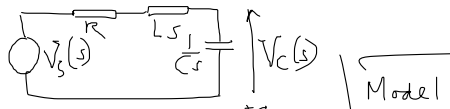
$$i(t) = \mathcal{L}^{-1}\{I(s)\} = \mathcal{L}^{-1}\frac{V_c(s)}{Z_c} = \mathcal{L}^{-1}\frac{V/LC}{s\left(s^2+\frac{R}{L}s+\frac{1}{LC}\right)}$$

$$= \mathcal{L}^{-1}\frac{V/L}{s^2+\frac{R}{L}s+\frac{1}{LC}} = \mathcal{L}^{-1}\frac{K}{s^2+2\xi\omega_n s+\omega_n^2}$$

$\xi > 1 \rightarrow \mathcal{L}^{-1}\dfrac{K}{(s+a)(s+b)}$

$\xi = 1 \rightarrow \mathcal{L}^{-1}\dfrac{K}{(s+a)^2}$

$0 < \xi < 1 \rightarrow \mathcal{L}^{-1}\dfrac{K}{s^2+2\xi\omega_n s+\omega_n^2}$



$$V_s(s) = \mathcal{L}\{V_u(t)\} = \frac{V}{s}$$

$$V_c(s) = \frac{Z_c}{Z_R+Z_L+Z_c}\cdot V_s(s)$$

$$= \frac{\frac{1}{Cs}}{R+Ls+\frac{1}{Cs}}\cdot\frac{V}{s}$$

$$= \frac{V}{s(LCs^2+RCs+1)}$$

$$= \frac{V/LC}{s\left(s^2+\frac{R}{L}s+\frac{1}{LC}\right)}$$

$v_c(t)$ ANALITIK

$$= \mathcal{L}^{-1}\frac{V/LC}{s\left(s^2+\frac{R}{L}s+\frac{1}{LC}\right)}$$

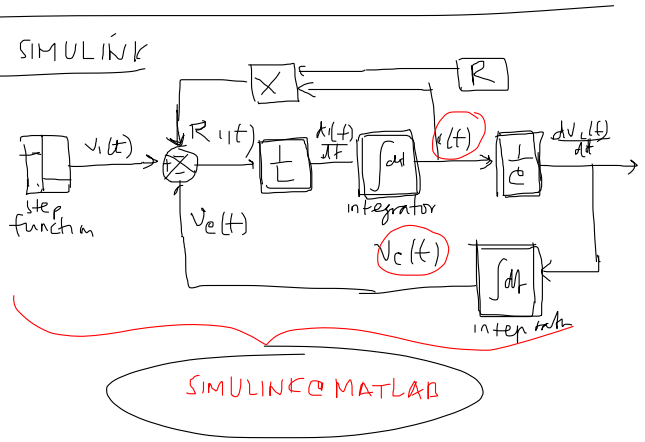
$$= \mathcal{L}^{-1}\frac{K}{s(s^2+2\xi\omega_n s+\omega_n^2)}$$

$\omega_n^2 = 1/LC$

$\omega_n = 1/\sqrt{LC}$

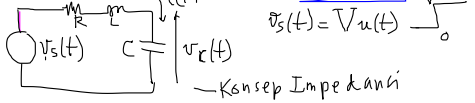
$2\xi\omega_n = \frac{R}{L} \rightarrow \xi$

Model SIMULINK



SIMULINK® MATLAB

* VALIDASI → di LAB
* VERIFIKASI → referensi: Hasil perhitungan ANALITIK



$V_s(t) = V_u(t)$ V

Konsep Impedansi