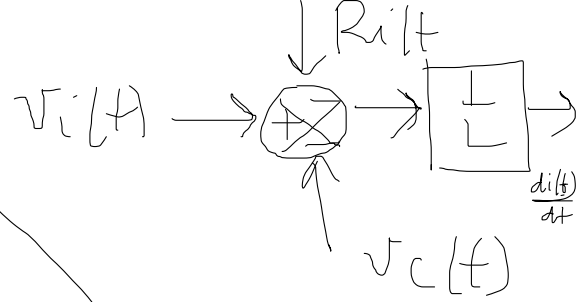


$$\frac{di(t)}{dt} = \frac{1}{L} (v_o(t) - v_c(t) - Ri(t))$$

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



* SIMULINK

Hukum Ohm:

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

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

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

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

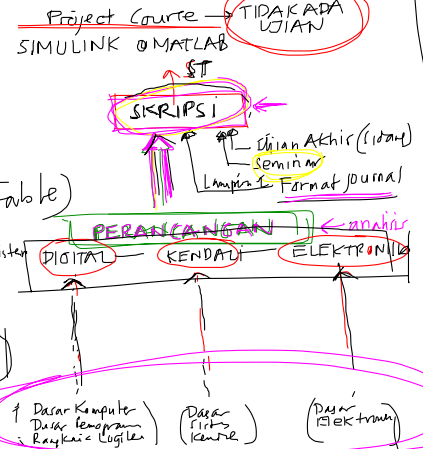
$$V_c(s) = \frac{V}{s(LCs^2 + RCs + 1)}$$

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

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

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

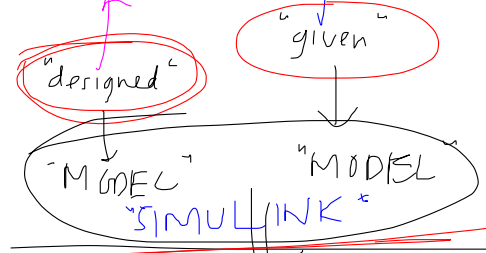
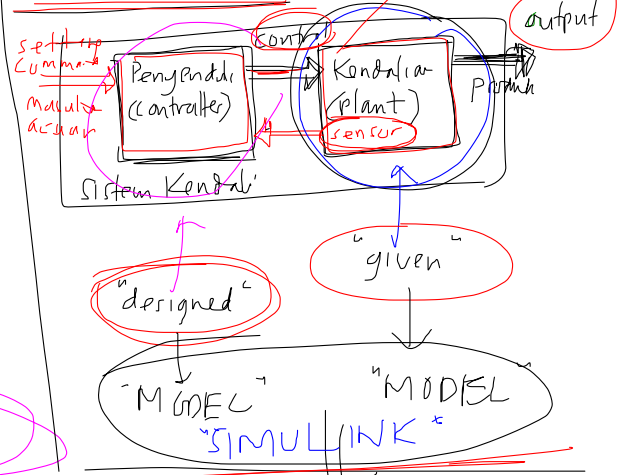
PERANCANGAN SISTEM KENDALI



Periapan: * Mencari MITRA (utk yang ingin bekerja bersama)
* Akses MATLAB → Simulink

Nerak: VERIFIKASI SIMULINK

SISTEM KENDALI

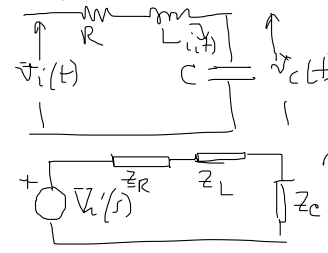


Project 1: Verifikasi Simulink

toleransi

* ANALITIK

Menggunakan Konsep Impedansi



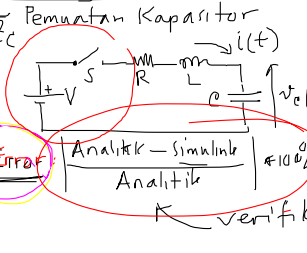
$$I(s) = \frac{V_c(s)}{Z_c} = \frac{V}{Z_R + Z_L + Z_C}$$

$$V_c(s) = \frac{Z_c V(s)}{Z_R + Z_L + Z_C}$$

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

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

* Rangkaian RLC seri



Saklar S ditutup pada $t=0$, $v_c(0) = 0$
Tentukan $v_c(t)$ dan $i(t)$.
* ANALITIK → exact
* SIMULINK
verifikasi

* Dengan menggunakan spread-sheet,
 * can 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

9 tabel
 PENYAMPAIAN

Tabel Laplace:

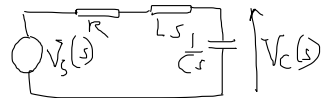
$$V_c(t) \rightarrow \begin{cases} * \xi > 1 \rightarrow \mathcal{L}^{-1} \frac{K}{s(s+a)(s+b)} \\ * \xi = 1 \rightarrow \mathcal{L}^{-1} \frac{K}{s(s+\omega_n)^2} \rightarrow \mathcal{L}^{-1} \frac{K}{s(s+a)^2} \\ * 0 < \xi < 1 \rightarrow \mathcal{L}^{-1} \frac{K}{s(s^2 + 2\xi\omega_n s + \omega_n^2)} \end{cases}$$

Tugas 1 Verifikasi SIMULINK
 * Ambil tgl lahir dan salah seorang
 TT-BB-IGHH $V = 12$ Volt
 $C = 10$ HH $RF = 10$ HH $\times 10^{-6}$ F
 $L = 88$ Henry
 $R = TT$ Ohm

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

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

$$\begin{cases} \xi > 1 \rightarrow \mathcal{L}^{-1} \frac{K}{(s+a)(s+b)} \\ \xi = 1 \rightarrow \mathcal{L}^{-1} \frac{K}{(s+a)^2} \\ 0 < \xi < 1 \rightarrow \mathcal{L}^{-1} \frac{K}{s^2 + 2\xi\omega_n s + \omega_n^2} \end{cases}$$



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

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

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

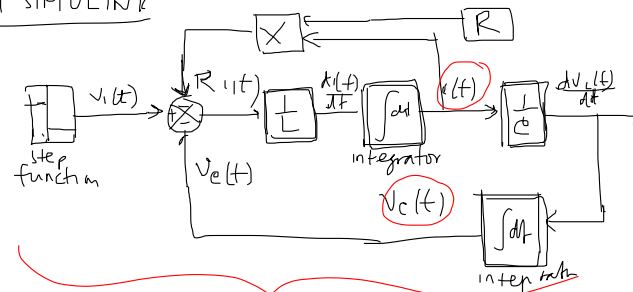
$$= \frac{V}{s(LCs^2 + RCs + 1)}$$

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

$$V_c(t) \text{ ANALITIK } \begin{cases} = \mathcal{L}^{-1} \frac{V/LC}{s(s^2 + \frac{R}{L}s + \frac{1}{LC})} \\ = \mathcal{L}^{-1} \frac{K}{s(s^2 + 2\xi\omega_n s + \omega_n^2)} \end{cases}$$

$$\begin{aligned} \omega_n^2 &= \frac{1}{LC} \\ \omega_n &= \frac{1}{\sqrt{LC}} \\ 2\xi\omega_n &= \frac{R}{L} \rightarrow \xi \end{aligned}$$

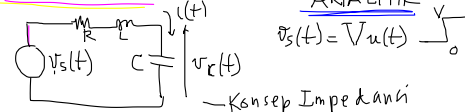
Model SIMULINK



SIMULINK @ MATLAB

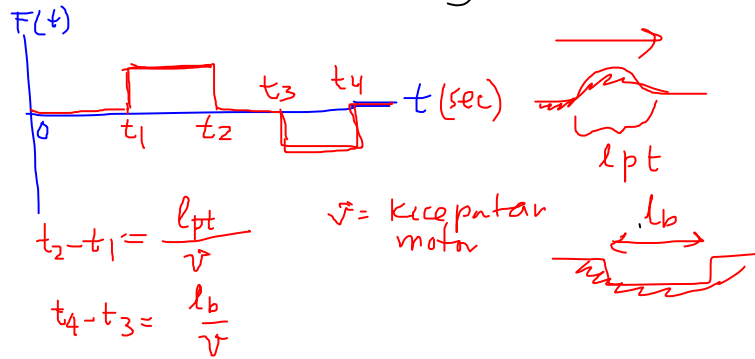
* VALIDASI $\rightarrow$ di LAB

* VERIFIKASI $\rightarrow$ referensi: Hasil perhitungan ANALITIK



- Konsep Impedansi

Simulasi Gaya guncangan

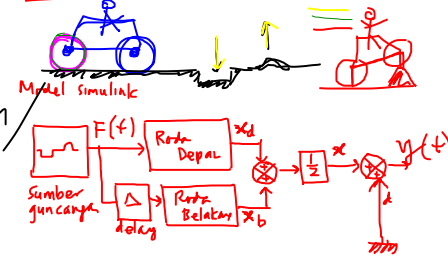


Diunduh dari:

<http://www.unha.ac.id/rhiza/arsip/kuliah/>

cari Perancangan - Sistem - Kontrol

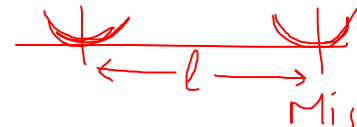
SISTEM SUSPENSI SEPEDA MOTOR



tanah = permukaan jalan
 $F(t)$ gaya guncangan
 $y(t)$ posisi pengendara terhadap tanah
 d = jarak antara sadel dengan tanah

Δ = delay antara roda depan dan roda belakang

$$\Delta = \frac{l}{v} \text{ [second]}$$



$$v = 5 \text{ km/jam}$$

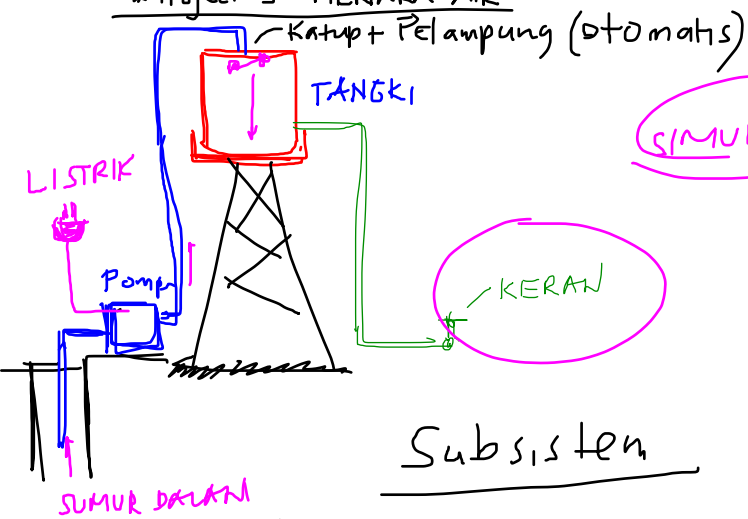
$$l = 1,2 \text{ m}$$

$$\text{Jadi } \Delta = \frac{1,2 \text{ m}}{5000 \text{ m} / 3600 \text{ s}}$$

$$= \frac{1,2 \times 3600}{5000} \text{ s}$$

$$= 0,864 \text{ s}$$

* Project 3 MENARA AIR



SIMULINK

Jika keran dibuka maka air mengalir ke luar dengan debit K liter/sec

