Identification Model Motor DC

(Ini adalah contoh template PPT dengan LaTex)

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Outline

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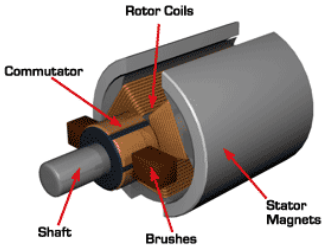
Pendahuluan

Pengertian Motor DC

Motor DC atau dalam bahasa Indonesia disebut motor arus searah adalah ....

Ilustrasi Motor DC:



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Struktur Fisik

Parameter:

J	:	Momen inersia rotor $(Kg.m^2)$
b	:	Koefisien gaya gesek viskos $(N.m.s)$
Ke	:	Koefisien gaya elektromotif $(V/rad/sec)$
Kt	:	Koefisien torsi motor $(N.m/Amp)$
R	:	Resistansi kumparan (Ohm)
L	:	Induktansi kumparan (H)

Skematik Motor DC:

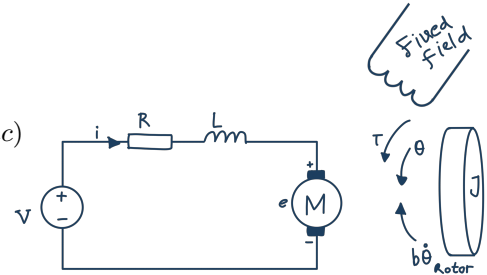
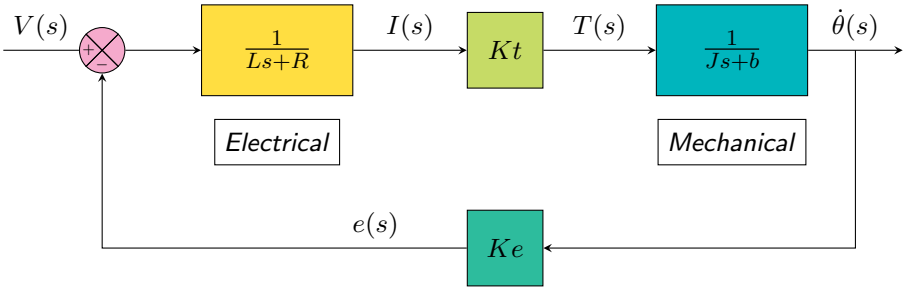


Diagram Blok Plant Motor DC

Struktur motor DC:



Fungsi Alih

Diagram blok *plant* motor DC menghasilkan persamaan fungsi alih berikut:

$$\frac{\dot{\theta}(s)}{V(s)} = \frac{Kt}{(Js+b)(Ls+R)+KtKe} \qquad \left[\frac{rad/sec}{V}\right] \tag{1}$$

Persamaan di atas merupakan fungsi alih kecepatan motor DC. Dengan mengintegralkan fungsi alih tersebut, maka diperoleh fungsi alih untuk posisi motor DC:

$$\frac{\theta(s)}{V(s)} = \frac{Kt}{s((Js+b)(Ls+R)+KtKe)} \qquad \left[\frac{rad}{V}\right] \tag{2}$$

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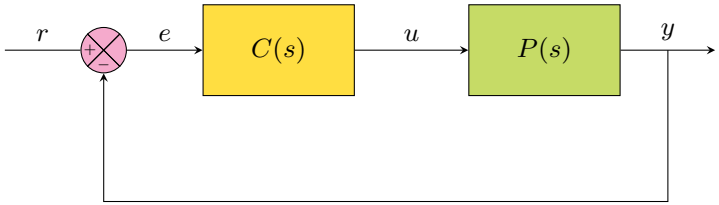
Diagram Blok Kendali



Keterangan:

$C(s)$	:	*Controller*
$P(s)$	:	*Plant*
$r(s)$	:	*Output* yang diinginkan
$e(s)$	:	Nilai *error*
$u(s)$	:	Sinyal kendali
$y(s)$	:	*Output* sesungguhnya

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Kendali PID

Contoh/ilustrasi perbandingan sistem dengan dan tanpa Kendali PID:

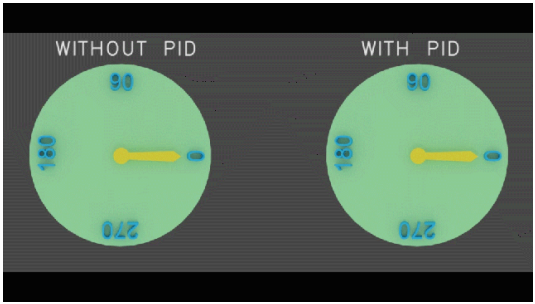


Diagram Blok Kendali PID Motor DC: Kecepatan

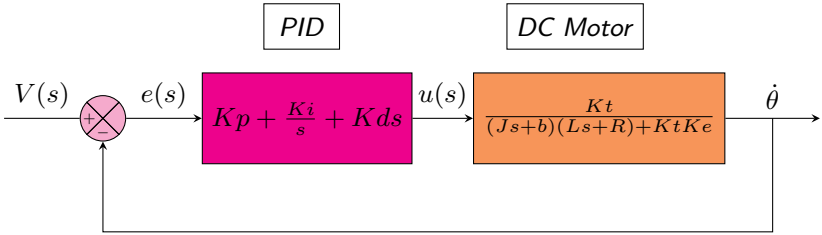
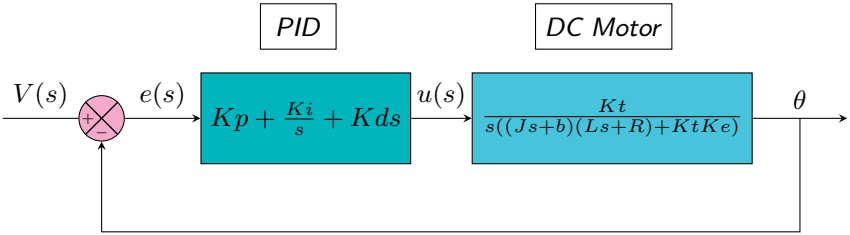


Diagram Blok Kendali PID Motor DC: Posisi



Uji Perbandingan Sistem *Open-loop* dengan *Closed-loop* Motor DC

Program *Open-loop*:

```
J = 3.2284E-6;
b = 3.5077E-6;
Kt = 0.0274;
Ke = 0.0274;
R = 4;
L = 2.75E-6;;
s = tf('s');
P_motor = Kt/((J*s+b)*(L*s+R)+Kt*Ke);
rP_motor = 0.1/(0.5*s+1)
ltiview('step', P_motor, 0:0.1:5);
```

Program *Closed-loop*:

```
J = 3.2284E-6;
b = 3.5077E-6;
Kt = 0.0274;
Ke = 0.0274;
R = 4;
L = 2.75E-6;
s = tf('s');
P_motor = Kt/((J*s+b)*(L*s+R)+Kt*Ke);
t = 0:0.001:0.2;
sys_cl = feedback(P_motor,1)
step(sys_cl,t)
```

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Kode Program Pada Matlab

```
% --- Outputs from this function are returned to the command line.
function varargout = LEDlagi2_OutputFcn(hObject, eventdata, handles)
varargout{1} = handles.output;
clear all;
global a;
a = arduino;

% --- Executes on button press in pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)
global a;
writeDigitalPin(a, 'D9',1);

% --- Executes on button press in pushbutton2.
function pushbutton2_Callback(hObject, eventdata, handles)
global a;
writeDigitalPin(a, 'D9',0);
```

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Kendali PID: Posisi

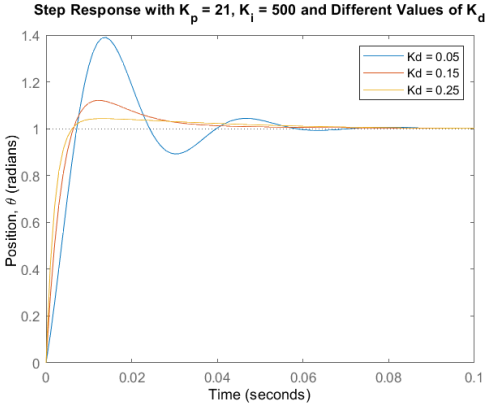
Program:

```
J = 3.2284E-6;
b = 3.5077E-6;
K = 0.0274;
R = 4;
L = 2.75E-6;
s = tf('s');
P_motor = K/(s*((J*s+b)*(L*s+R)+K^2));
Kp = 21;
Ki = 500;
Kd = 0.05;

for i = 1:3
  C(:,:,i) = pid(Kp,Ki,Kd);
  Kd = Kd + 0.1;
end

sys_cl = feedback(C*P_motor,1);
t = 0:0.001:0.1;
step(sys_cl(:,:,1), sys_cl(:,:,2), sys_cl(:,:,3), t)
ylabel('Position, \theta (radians)')
title('Step Response with K_p = 21, K_i = 500 and
      Different Values of K_d')
legend('Kd = 0.05', 'Kd = 0.15', 'Kd = 0.25')
```

Hasil:



Embedded Video

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Embedded Video

References

- Fahmizal, H. A. Nugroho, A. I. Cahyadi, I. Ardiyanto *et al.*, "Attitude control of uav bicopter using adaptive lqg," *Results in Control and Optimization*, vol. 17, p. 100484, 2024.
- ——, "Attitude control and low cost design of uav bicopter," *arXiv preprint arXiv:2309.08209*, 2023.
- ——, "Trajectory tracking control of uav bicopter using linear quadratic gaussian," *arXiv preprint arXiv:2309.08226*, 2023.

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Q&A

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