

Aplikasi Teknik PID pada Kontrol Internal Robot (low level control)

Low-level & High Level Control

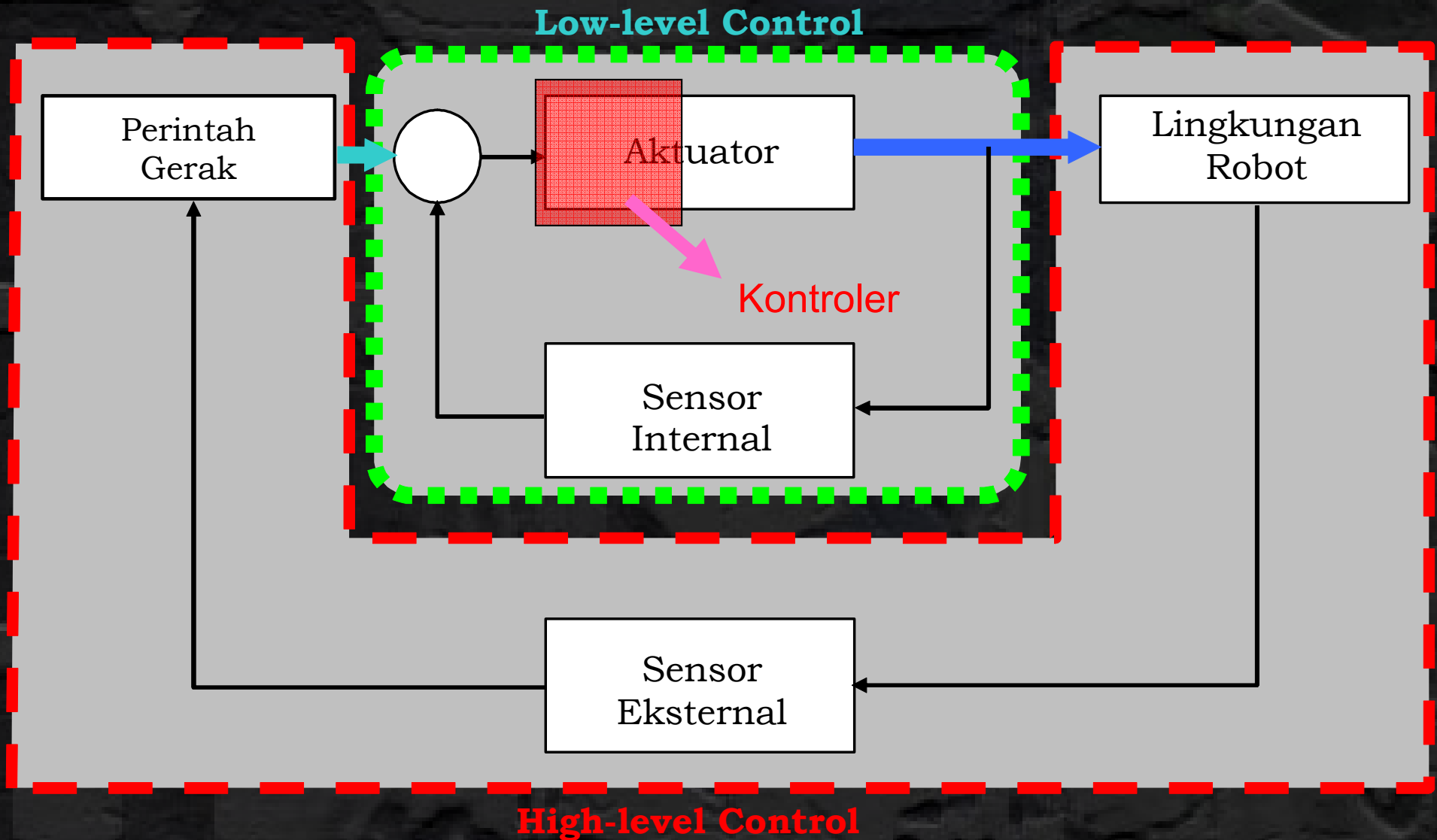
Sensor Internal:

sensor posisi,
sensor kecepatan, dan
sensor percepatan,

Sensor Eksternal:

sensor taktil (tactile), berbasis sentuhan: misalnya limit switch pada bumper robot
sensor force dan sensor torsi (torque sensor),
sensor proksimiti,
sensor jarak (sonar, PSD, dll),
sensor vision (kamera),
gyro, kompas digital, detektor api, dan sebagainya.

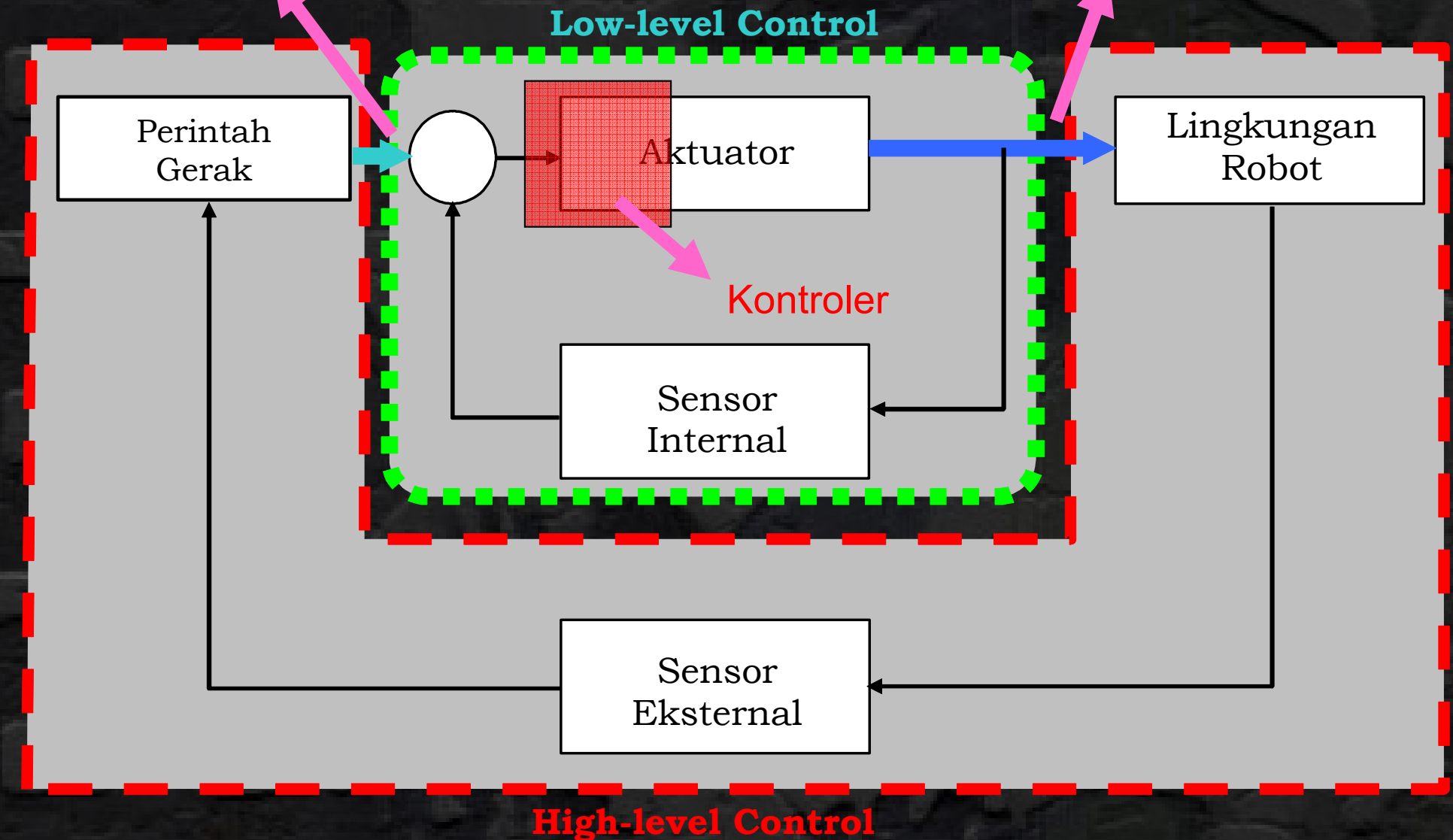
Low-level & High Level Control



Kontrol Posisi

Referensi posisi yg selalu berubah

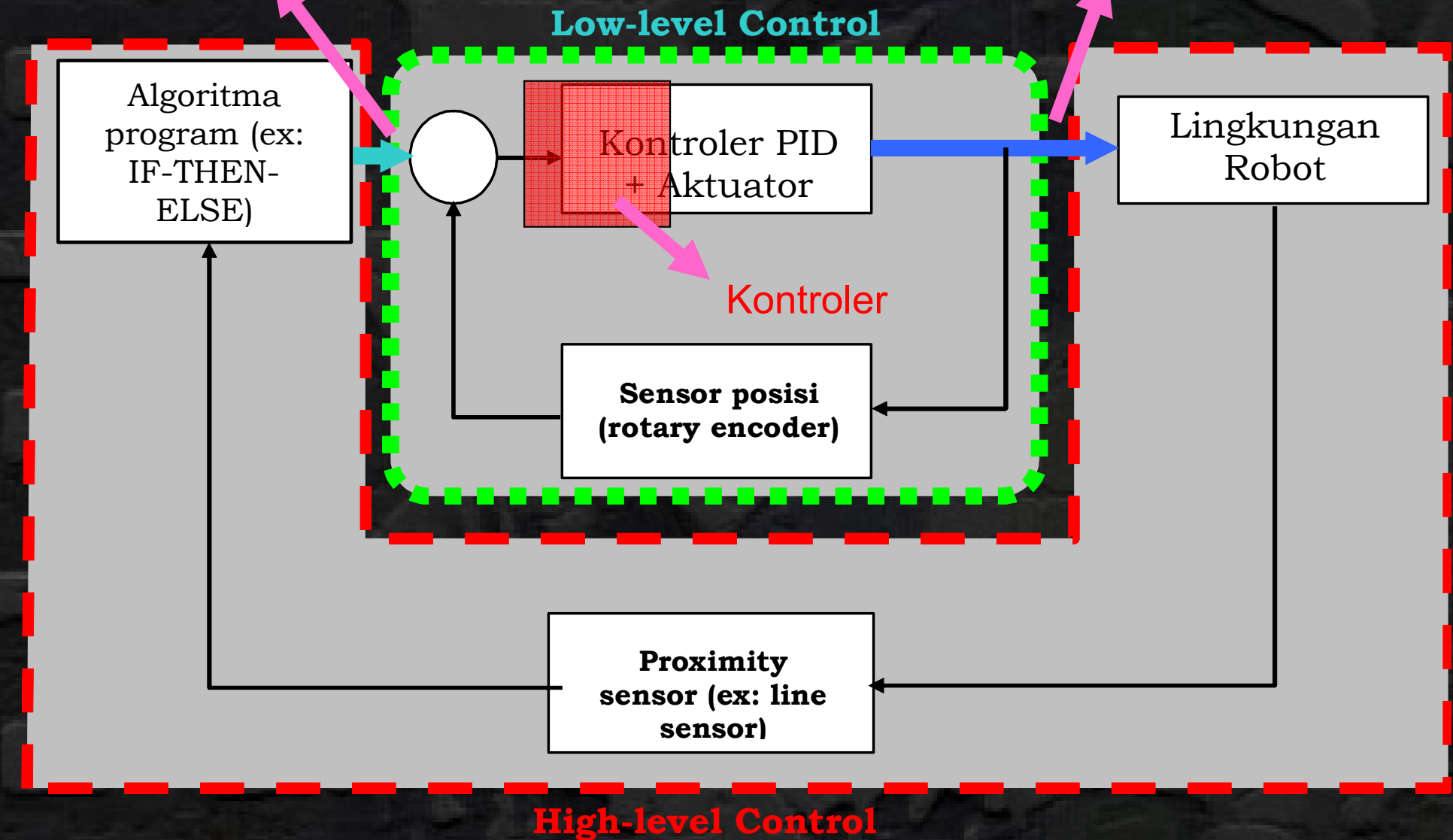
Posisi aktual tiap derajat aktuator



Kontrol Posisi

Referensi posisi yg selalu berubah

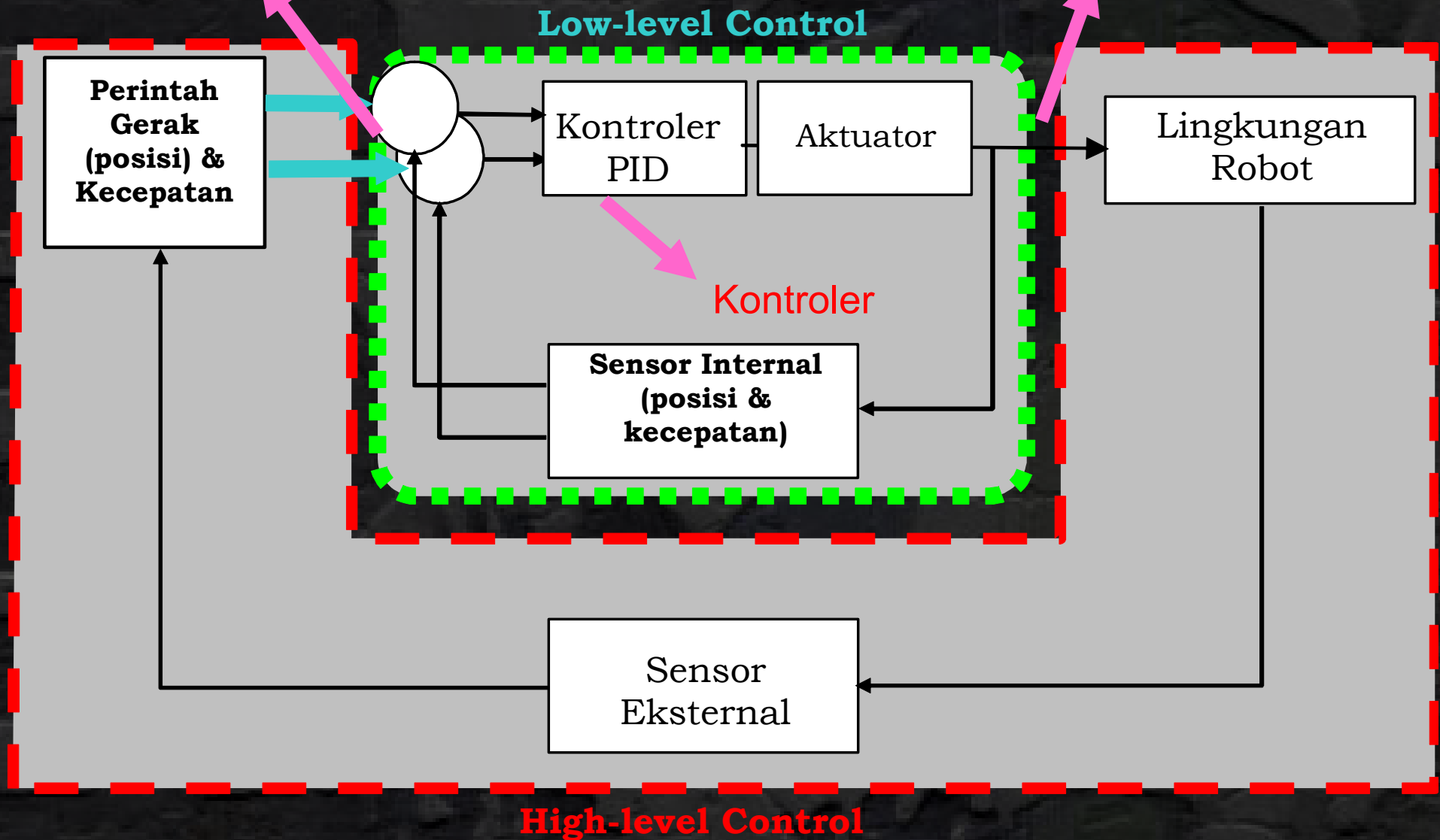
Posisi aktual tiap derajat aktuator



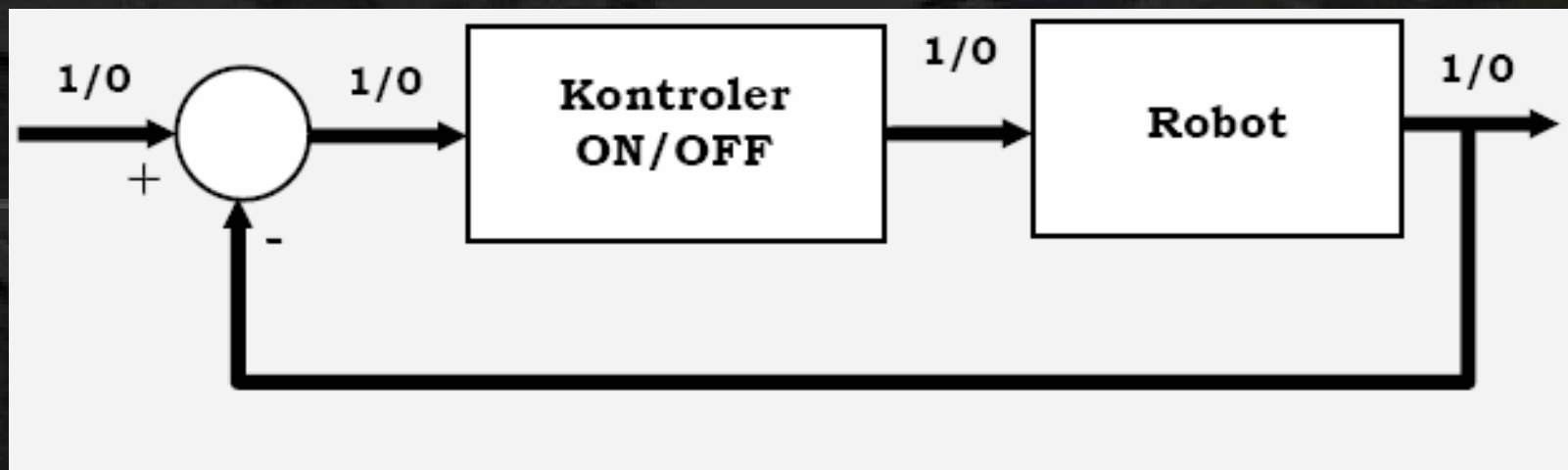
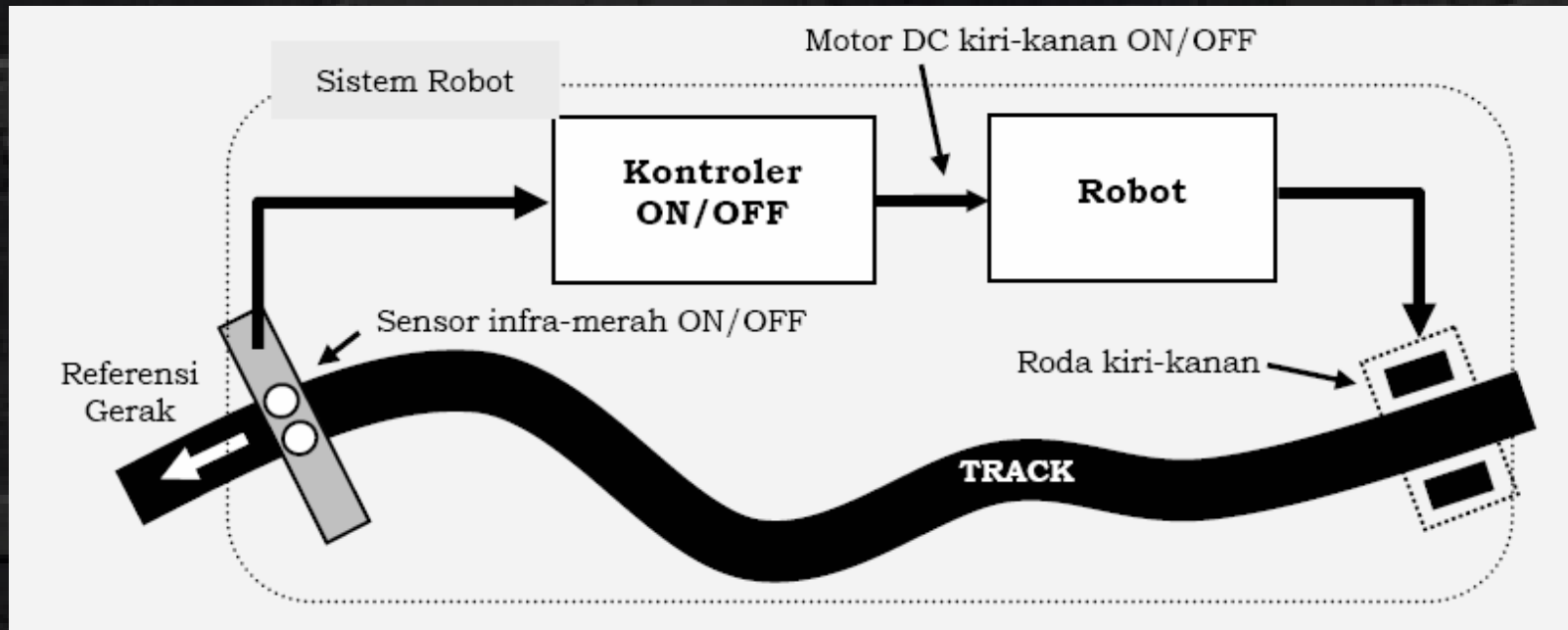
Kontrol Posisi & Kecepatan

Referensi posisi & kecepatan yg selalu berubah

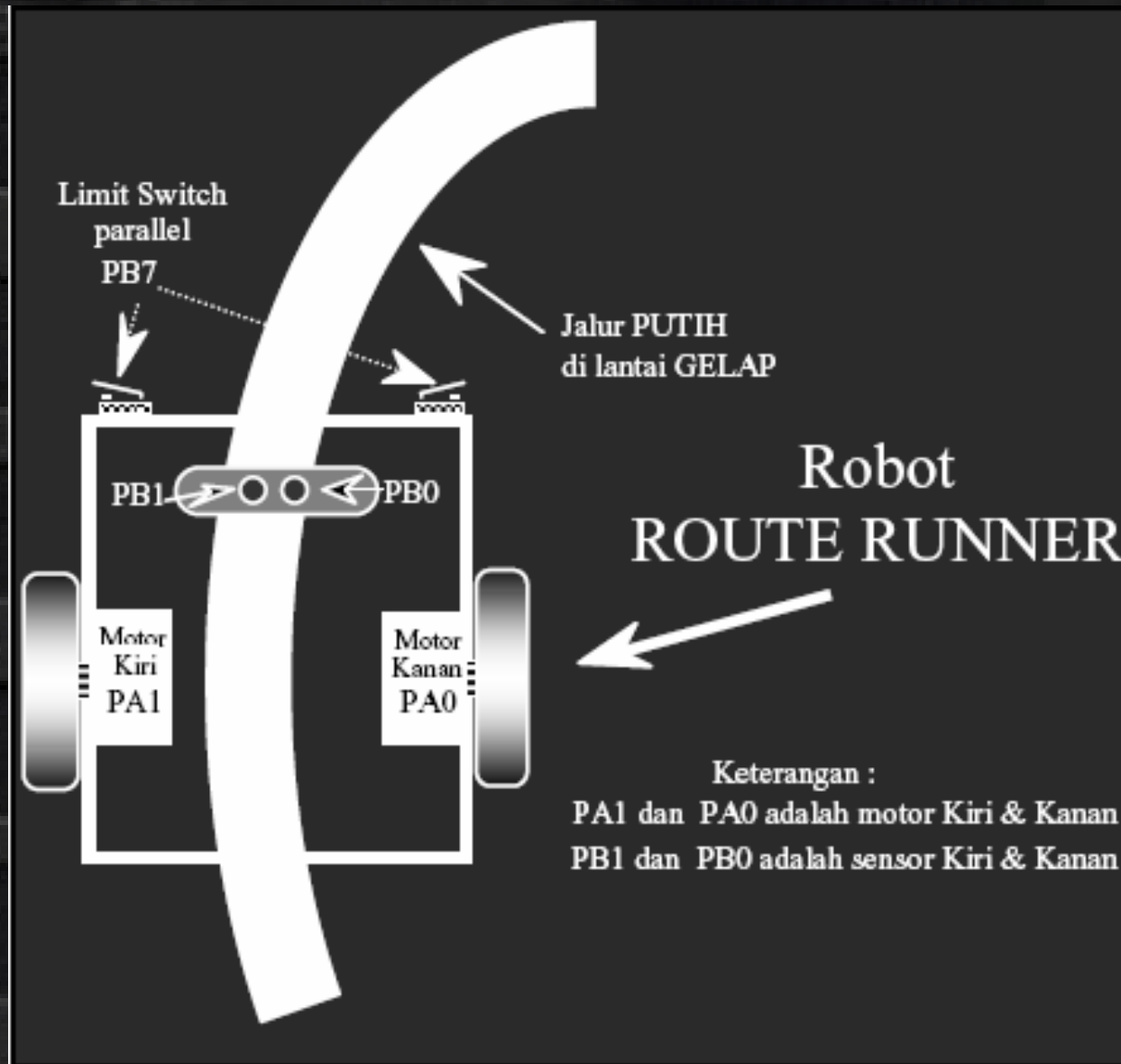
Posisi & kecepatan aktual tiap derajat aktuator



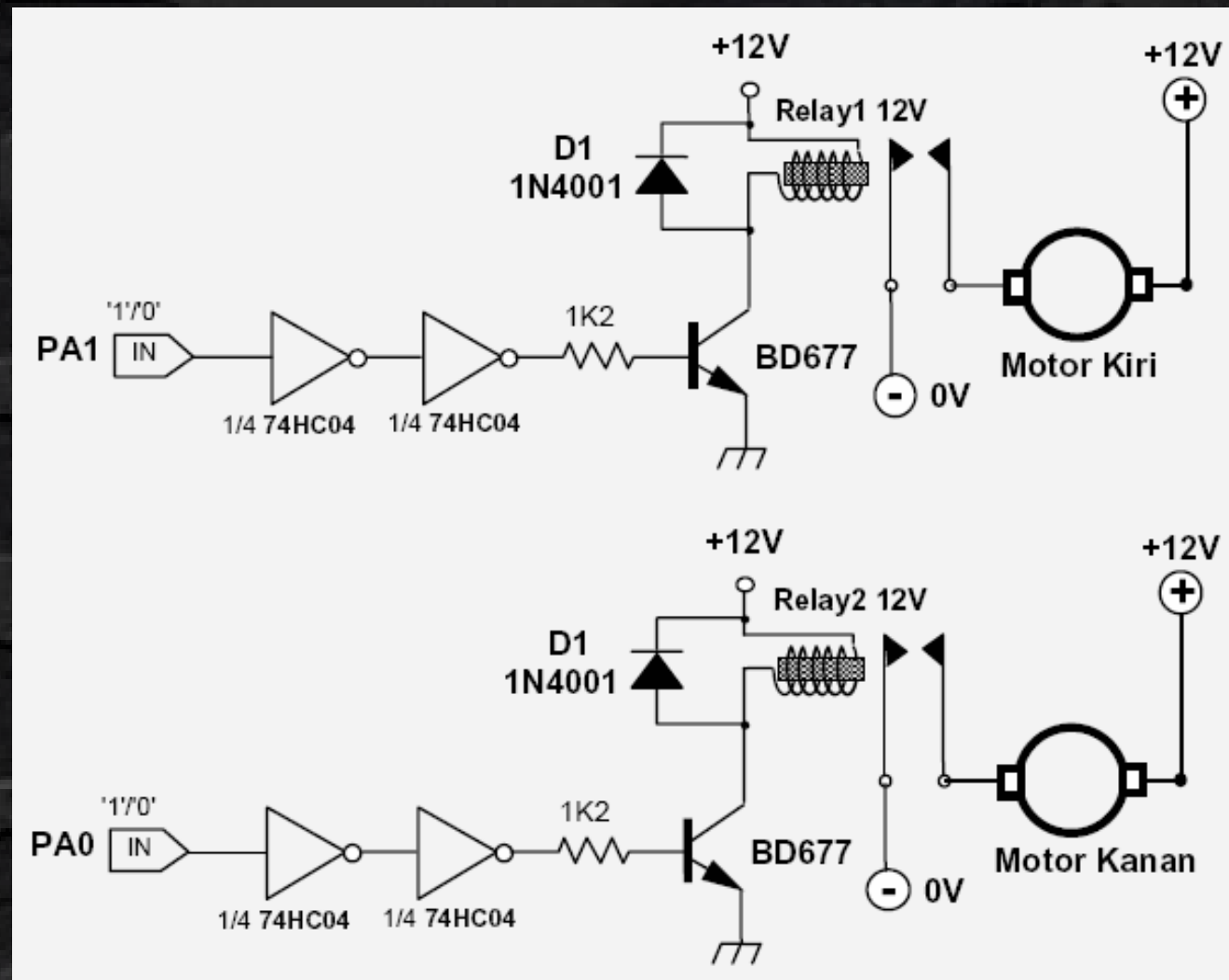
Kontrol ON/OFF



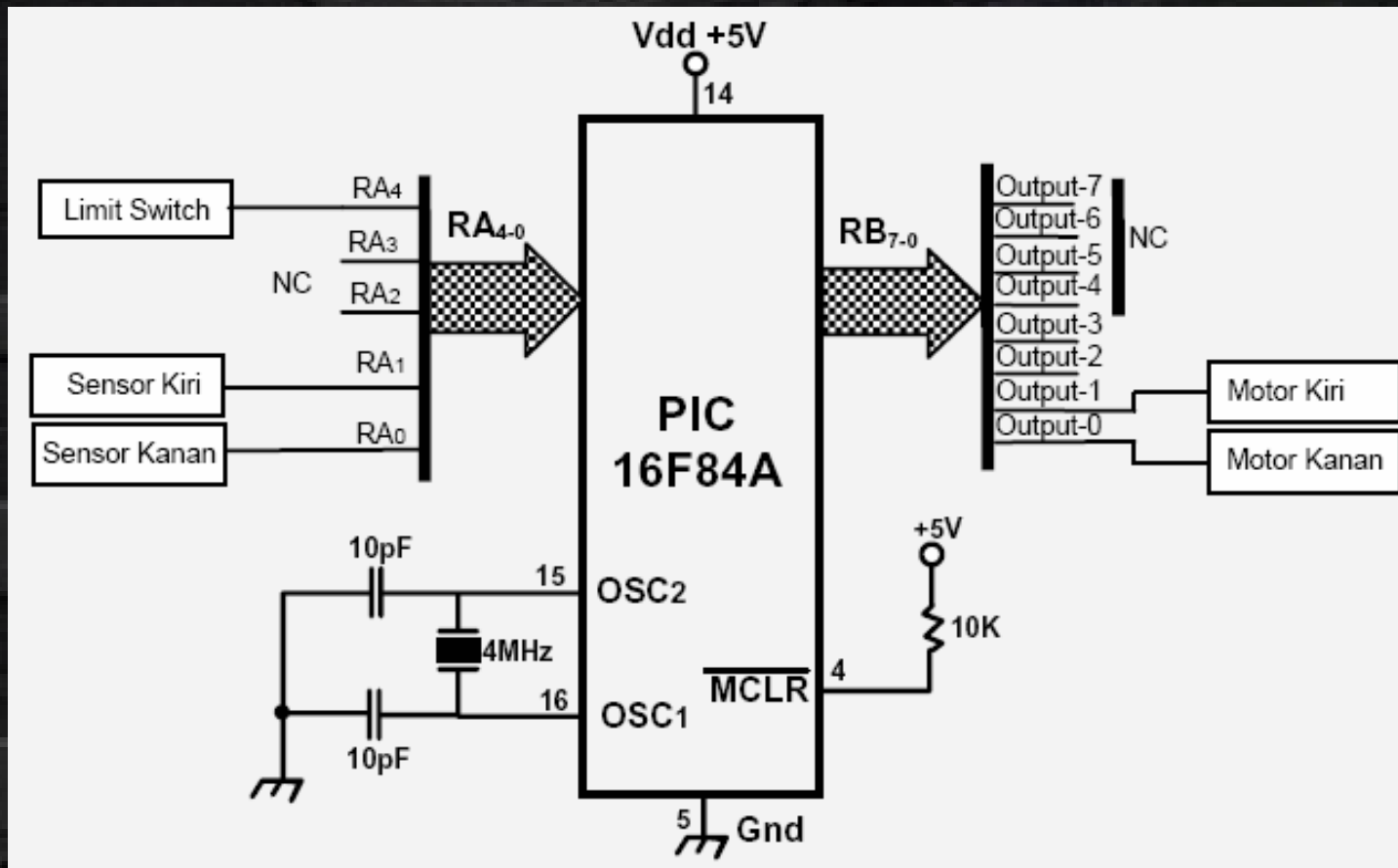
Kontrol ON/OFF



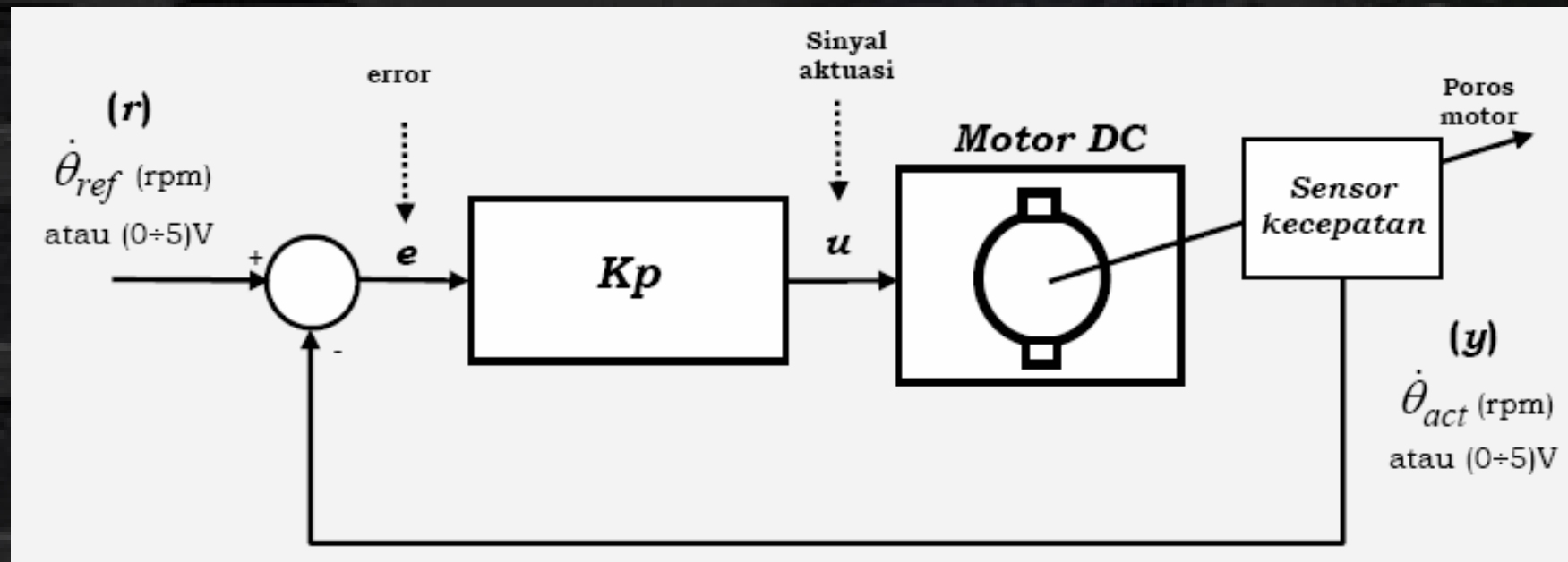
Driver Kontrol ON/OFF



Rangkaian Sistem Kontrol ON/OFF

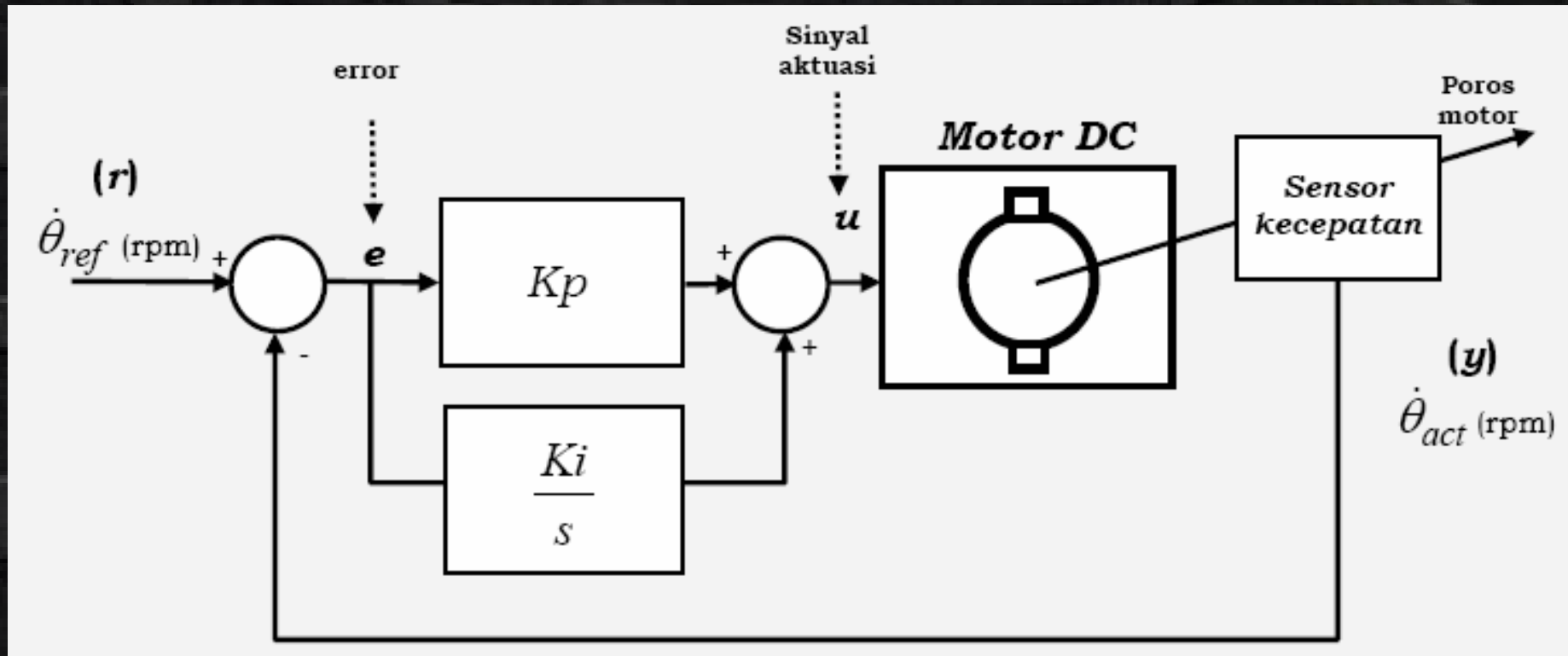


Kontrol Linier: Kecepatan (kontrol Proportional)



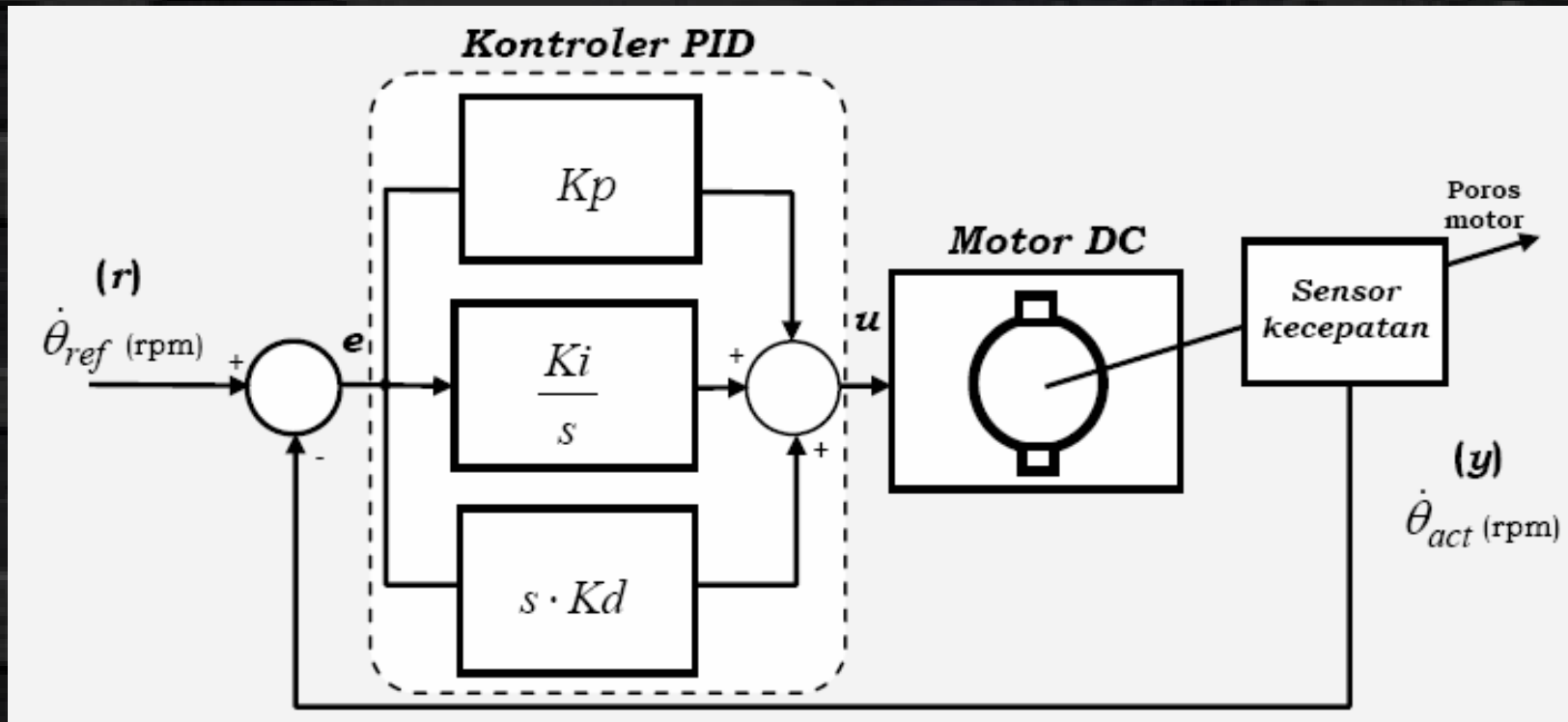
$$u(t) = K_p \cdot (\dot{\theta}_{ref}(t) - \dot{\theta}_{act}(t))$$

Kontrol Linier: Kecepatan (kontrol Proportional-Integral)



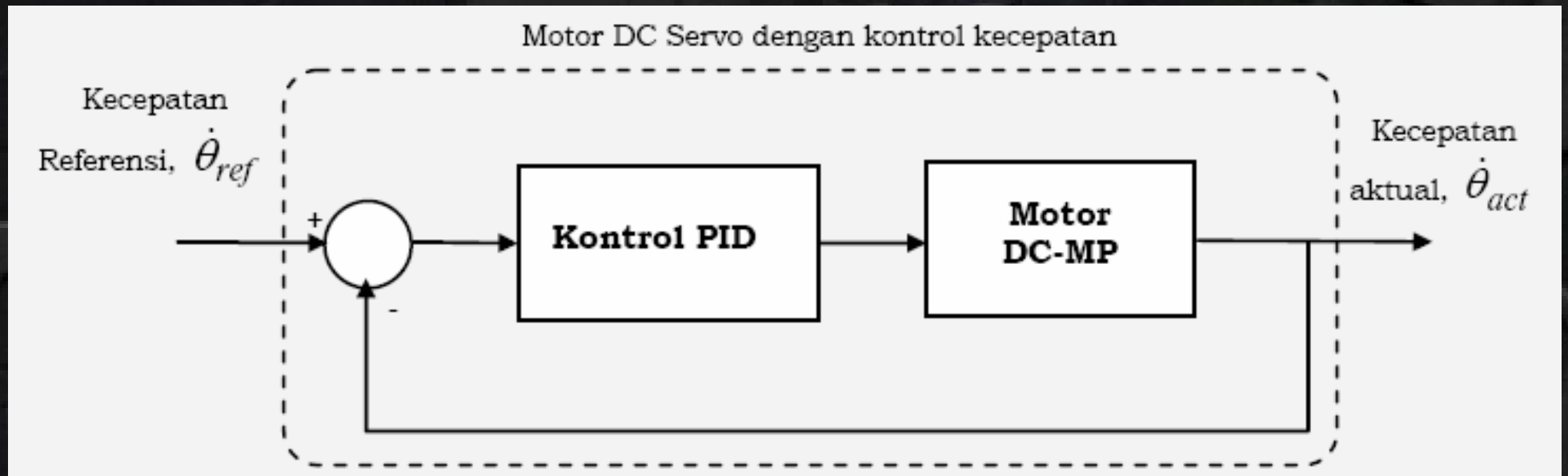
$$u(t) = K_p \cdot (\dot{\theta}_{ref}(t) - \dot{\theta}_{act}(t)) + K_i \int_0^t (\dot{\theta}_{ref}(t) - \dot{\theta}_{act}(t)) dt$$

Kontrol Linier: Kecepatan (kontrol Proportional-Integral-Derivative)

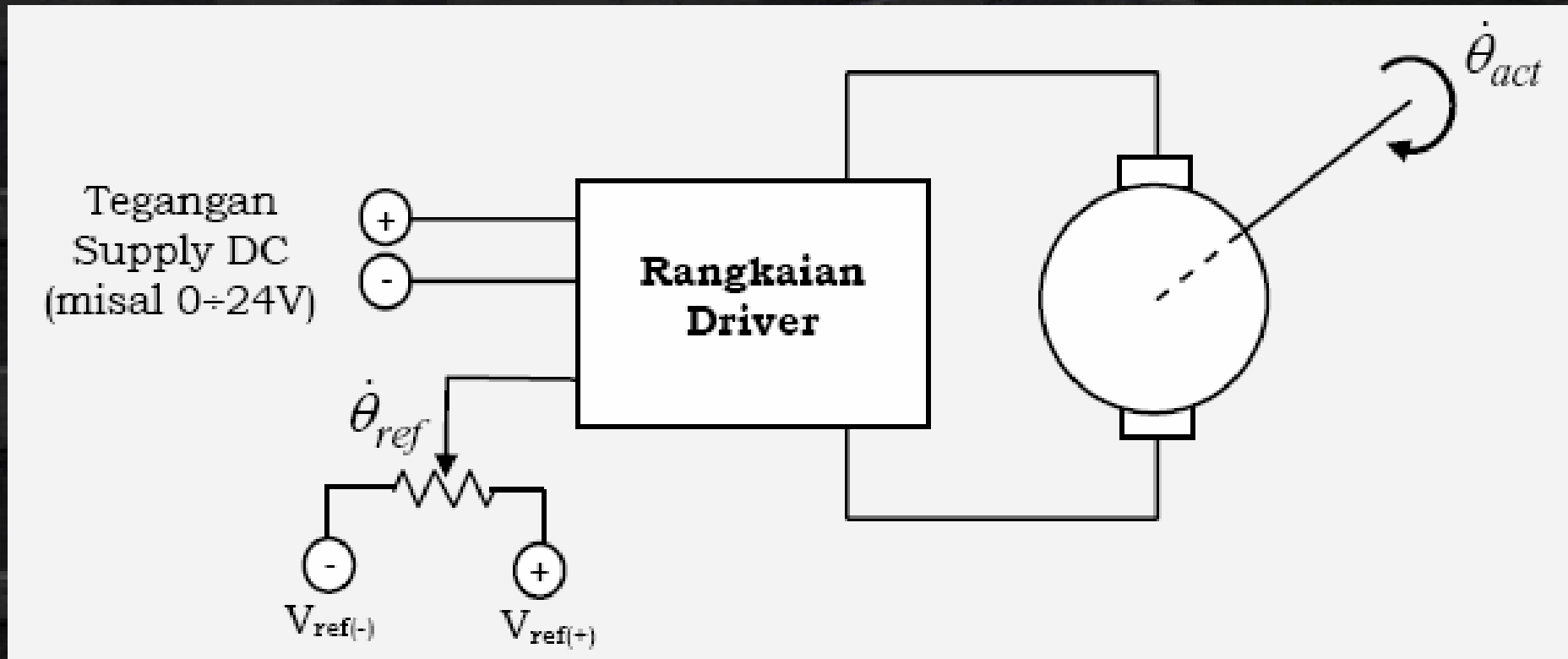


$$u(t) = K_p \cdot (\dot{\theta}_{ref}(t) - \dot{\theta}_{act}(t)) + K_i \int_0^t (\dot{\theta}_{ref}(t) - \dot{\theta}_{act}(t)) dt + K_d \cdot \frac{d(\dot{\theta}_{ref}(t) - \dot{\theta}_{act}(t))}{dt}$$

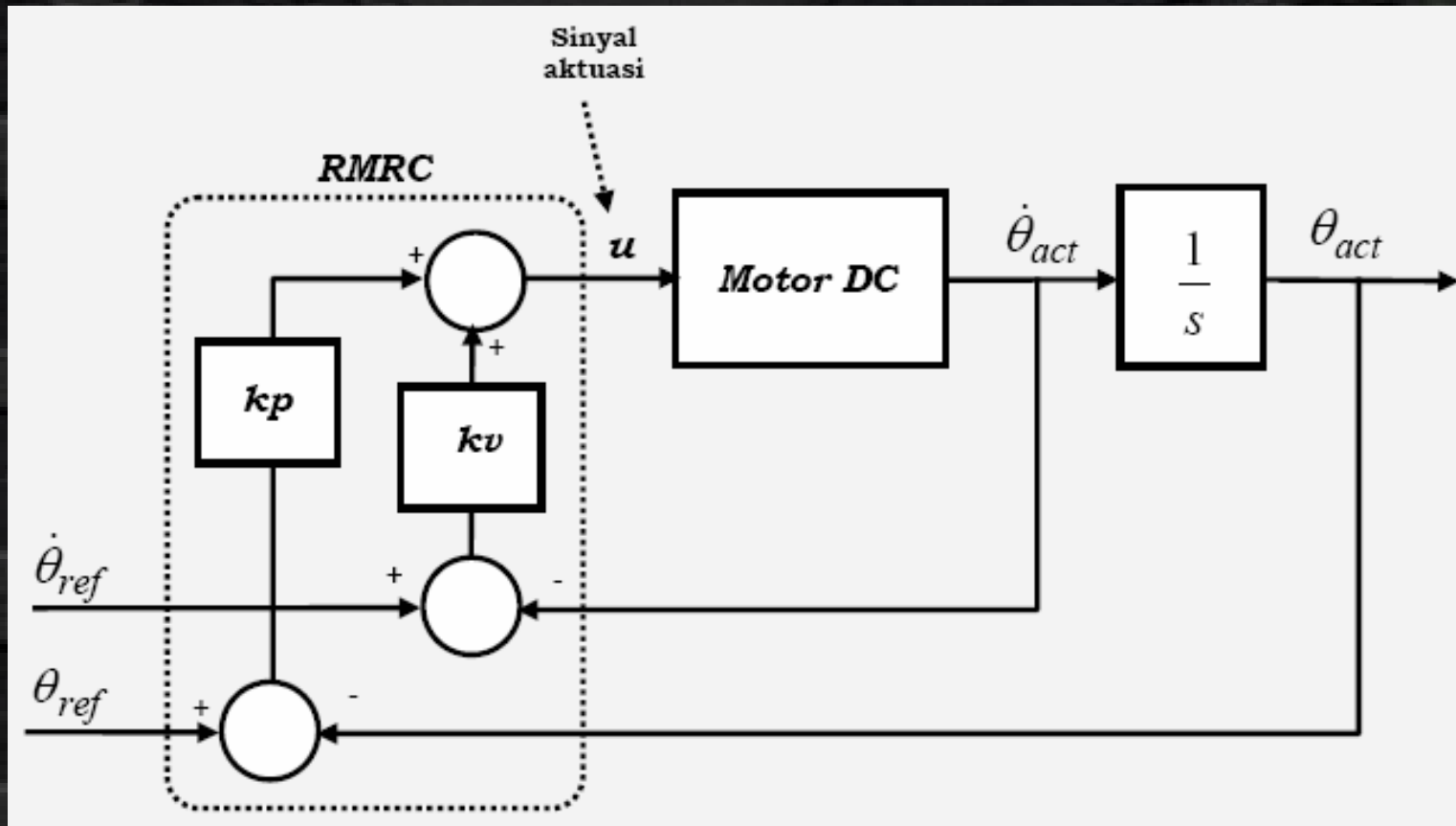
Skema ekivalen Motor DC Servo dengan kontrol kecepatan



Motor DC Servo dengan kontrol kecepatan



Studi Kasus: kontrol posisi & kecepatan



$$u(t) = k_p \cdot (\theta_{ref}(t) - \theta_{act}(t)) + k_v \cdot (\dot{\theta}_{ref}(t) - \dot{\theta}_{act}(t))$$

Mobile Manipulator Robot

