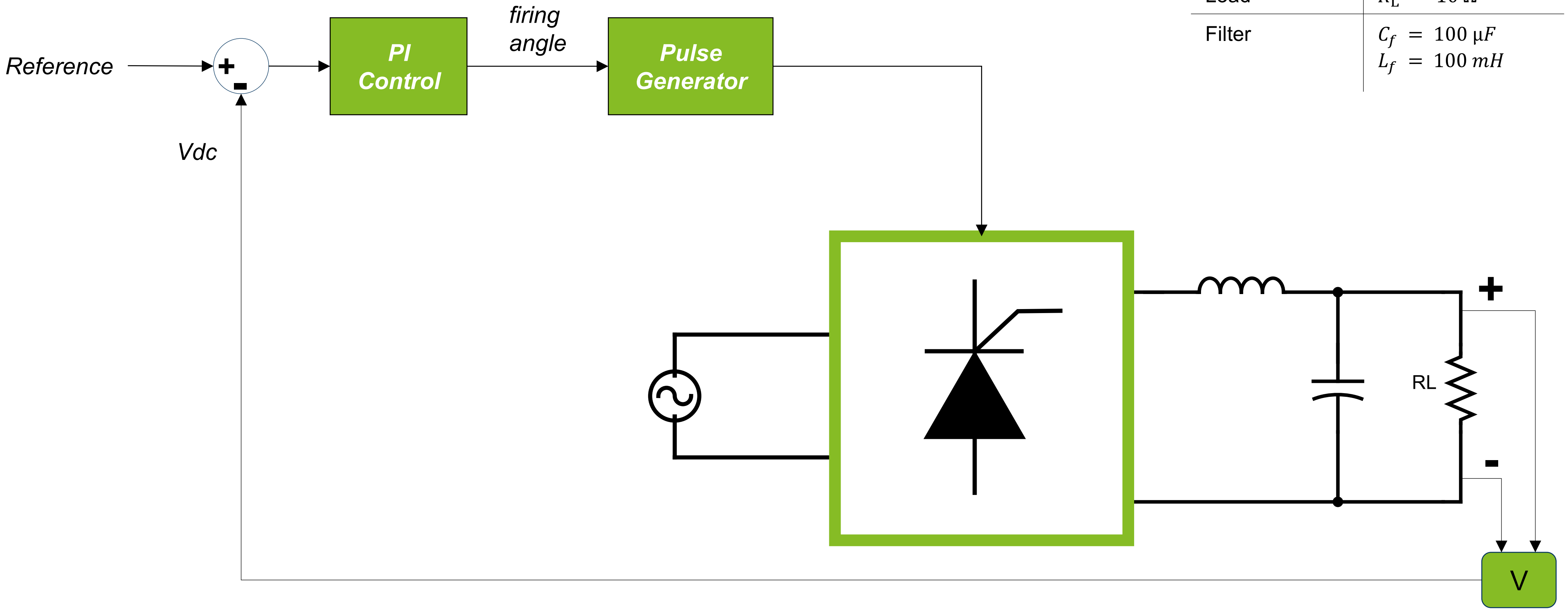
DC Voltage Controller

Block diagram of DC Voltage Control

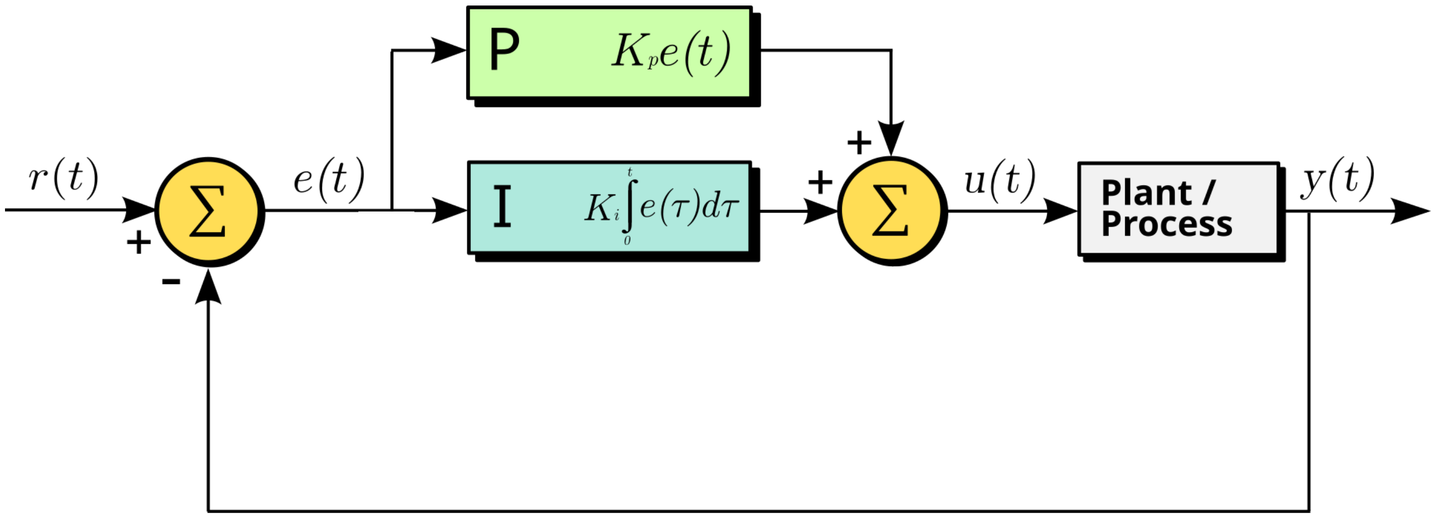


Parameters

Voltage Source	$200V\ Peak, 50Hz$
Load	$R_L = 10\,\Omega$
Filter	$C_f = 100\,\mu F$ $L_f = 100\,mH$

PI Control

PI control is a feedback back based control loop.



- **Proportional (P):** Responds to the error and producing an output that is directly proportional to the magnitude of the error.
  - As error approaches zero then Proportional will reach zero
- **Integral (I):** Cumulative sum of past errors and holds the required magnitude out control signal.
  - Responsible for reducing error

Properties

Proportional Gain K_P, Integral Gain K_i

Proportional Gain

- Increases **responsiveness** → higher Kp makes system react faster.
- **Reduces steady-state error** but cannot eliminate it completely.
- Too high Kp → causes **oscillations** or even instability.
- Too low Kp → system becomes sluggish.
- Affects **rise time** (lower rise time with higher Kp).

Integral Gain

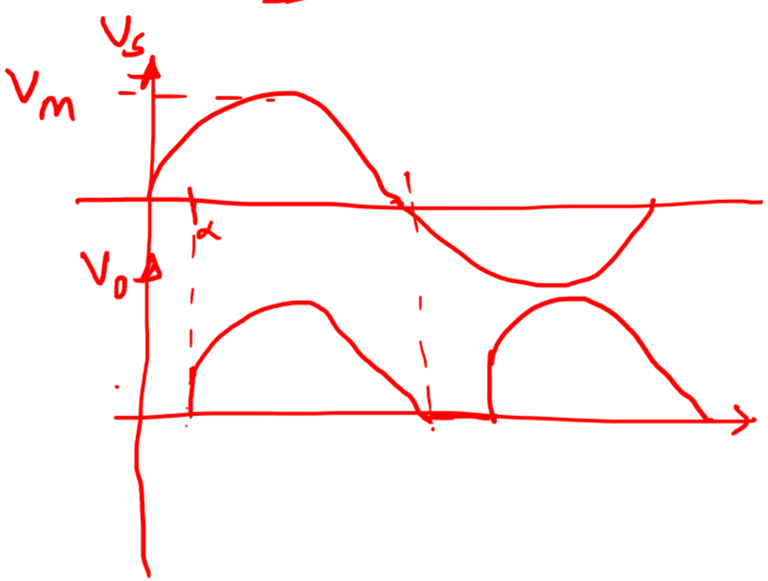
- **Eliminates steady-state error** completely (good for accuracy).
- Improves **tracking performance** for constant references.
- Increases **overshoot** and **oscillations** if too high.
- **Slows down** the system response (increases settling time if not tuned properly).

VEDIC SKILL.

$$V_{dc} = \frac{V_m}{2\pi}(1 + \cos\alpha)$$

α --> Firing angle

R-Load



$\alpha = 0^\circ \Rightarrow V_{dc} = \frac{V_m}{2\pi}(1+1) = \frac{V_m}{\pi}$

$\alpha = 90^\circ \Rightarrow V_{dc} = \frac{V_m}{2\pi}(1+0) = \frac{V_m}{2\pi}$

$\alpha = 180^\circ \Rightarrow V_{dc} = \frac{V_m}{2\pi}(1-1) = 0$

$\Rightarrow$ As Firing Angle Increases Output dc voltage decrease

vedic SKILL.

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https://www.udemy.com/user/freeai-space/

https://github.com/datascienceanywhere

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