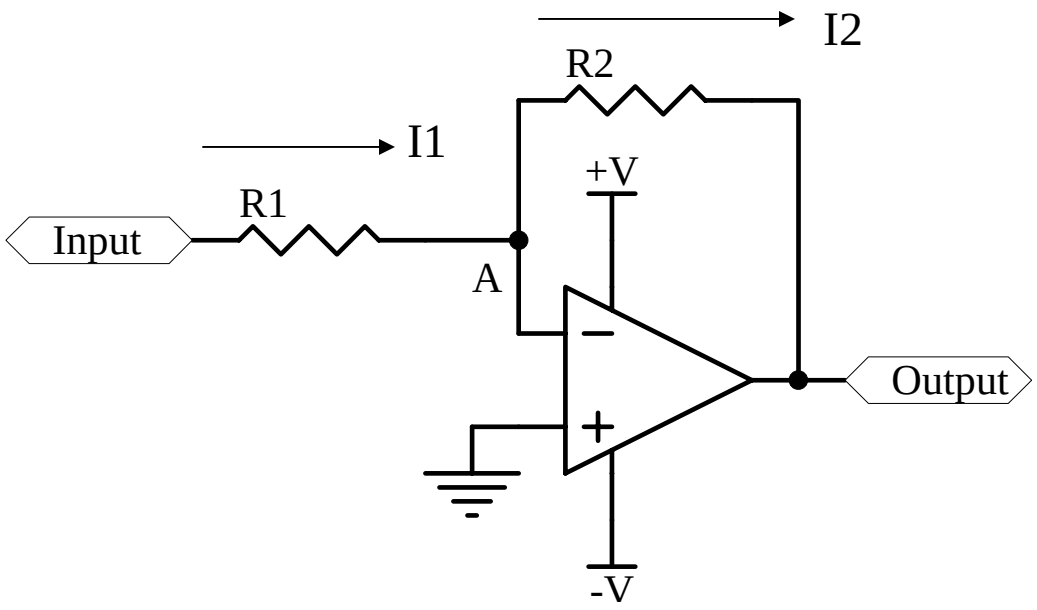
Elektronika Analog

Rangkaian Op-Amp

Op-Amp

- Impedansi Input tinggi
- Impedansi output rendah
- Penguatan open loop tinggi
- Pada saat berfungsi sebagai penguat tegangan dari input inverting ke input non inverting adalah 0 volt
- Apabila tegangan dari input inverting ke input non inverting lebih dari 0 volt, maka output akan mengalami saturasi

Rangkaian Inverting



Diketahui

VA = 0

Dimana

I1 = I2 = Vin/R1

A = Vout / Vin

Vin = I1.R1

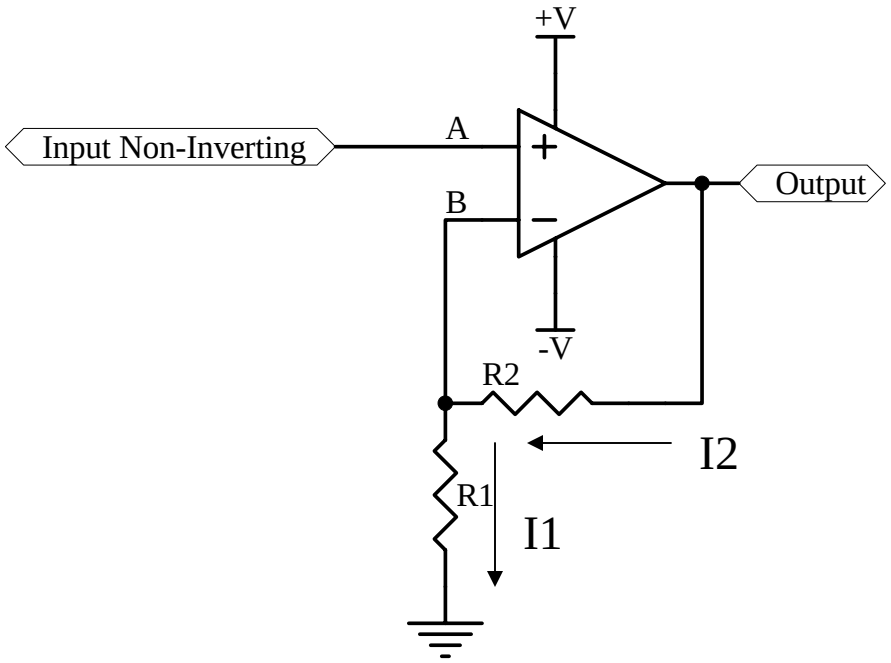
Vout = - I2 R2

Sehingga:

Vout = -R2/R1 * Vin

A = -R2/R1

Rangkaian Non-Inverting



Diketahui

VAB = 0

I1 = I2

Dimana

VB = R1/(R1+R2).Vout

Vin = VB

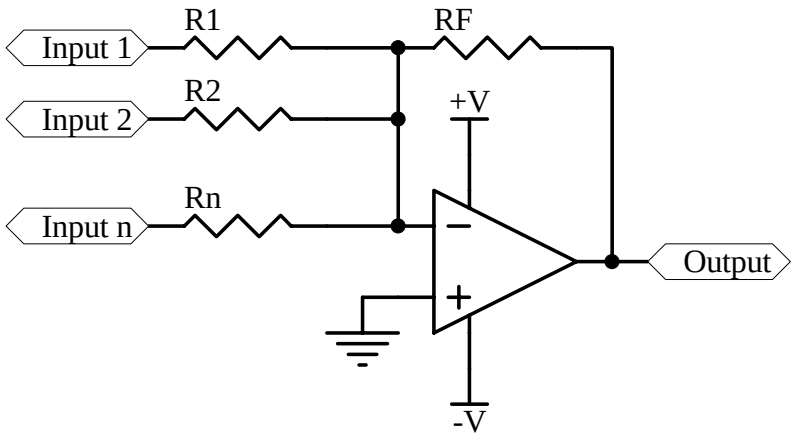
A = Vout / Vin

Sehingga:

Vout = (1 + R2/R1) * Vin

A = (1 + R2/R1)

Rangkaian Penjumlah



Diketahui

Vout = Vout1 + Vout2 + … + VoutN

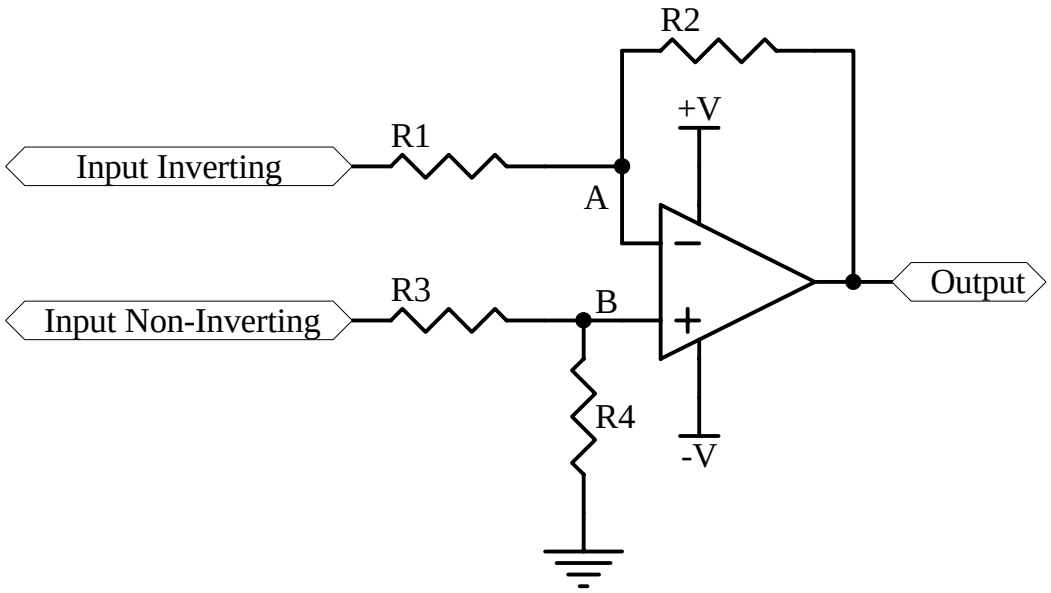
Dimana

Vout1 = -RF/R1 Vin1
Vout2 = -RF/R1 Vin2
Voutn = -RF/R1 VinN

Sehingga:

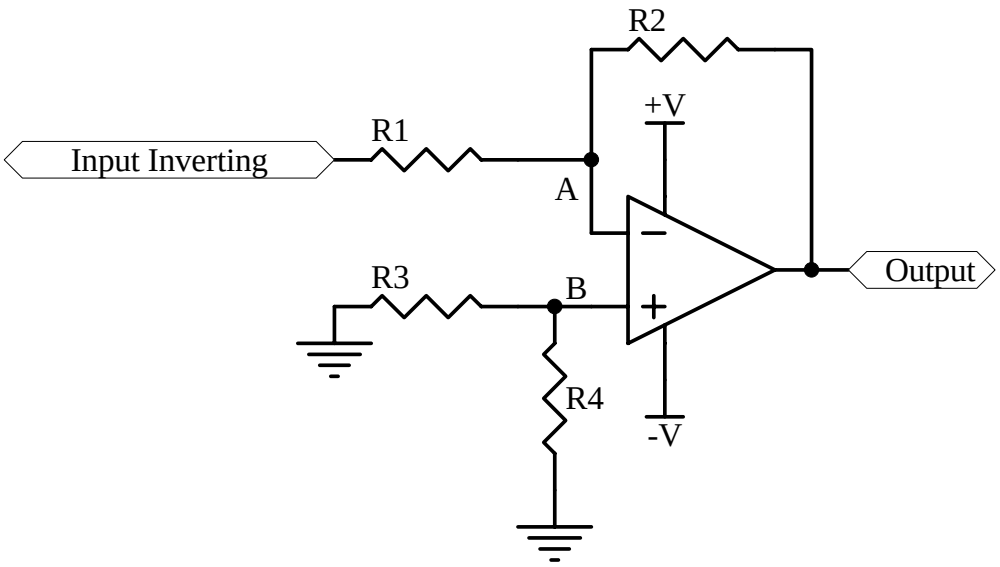
Vout = -RF.(Vin1/R1 + Vin2/R2 +….VinN/Rn

Rangkaian Pengurang (1/4)



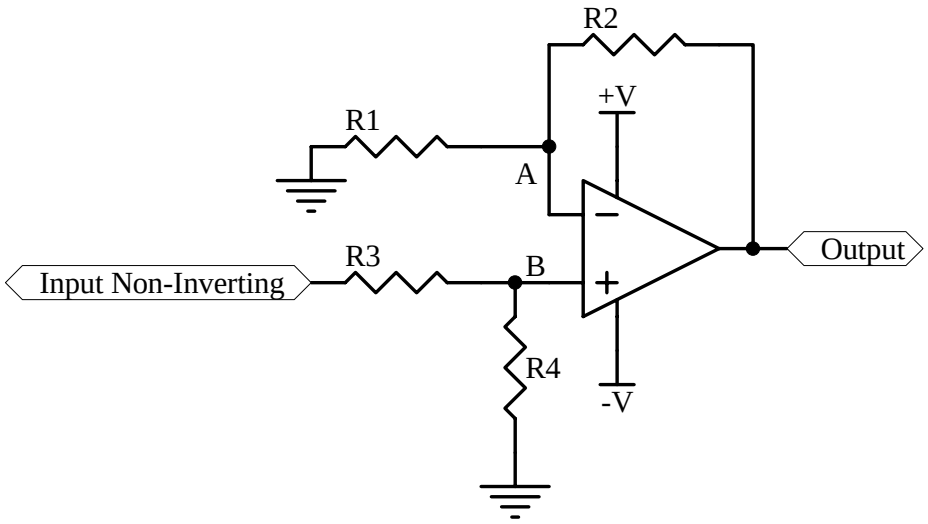
- Dengan menggunakan teorema super-posisi dapat dihitung sbb
  - Vout = Vout saat input non-ionverting = 0 ditambah dengan Vout saat input inverting = 0

Rangkaian Pengurang (2/4)



- Vout saat input non-inverting = 0 adalah
  - **Vout = - R2/R1 . Vin (inverting)**

Rangkaian Pengurang (3/4)



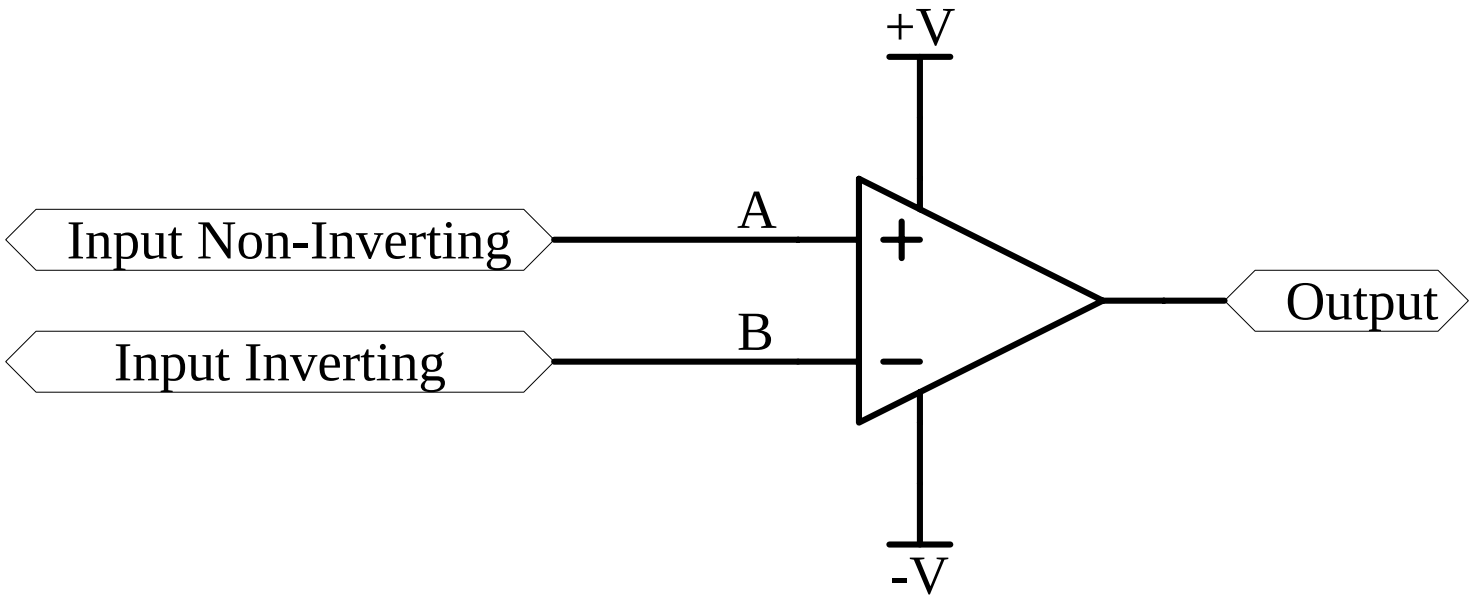
- Vout saat input inverting = 0 adalah
  - Vout = (1 + R2/R1) . VA
  - VA = (R4/(R3+R4)) Vin (non-Inverting)
  - **Vout = (1 + R2/R1) . (R4/(R3+R4)) Vin (non-Inverting)**

Rangkaian Pengurang (3/4)

- Vout = Vout Inverting + Vout non-Inverting
- Dengan notasi
    - V1 = Vin (inverting)
    - V2= Vin (non-inverting)

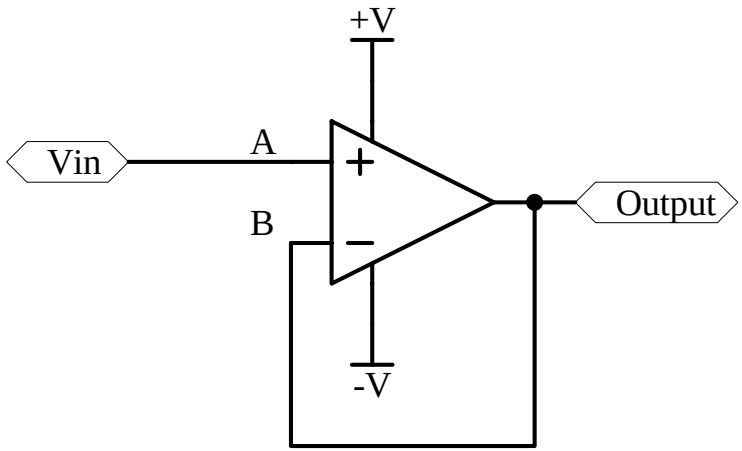
- Maka
- Vout = - R2/R1 . V1 + [(1 + R2/R1) . (R4/(R3+R4))] V2
- Apabila R1 = R3 dan R2=R4, maka
    - Vout = - R2/R1 . V1 + [(1 + R2/R1) . (R2/(R1+R2))] V2
    - Vout = R2/R1 (V2-V1)
    - Sehingga, apabila R1=R2=R3=R4, maka Vout = V2-V1
    - **Vout = V (non invering) – V (inverting)**

Rangkaian Pembanding



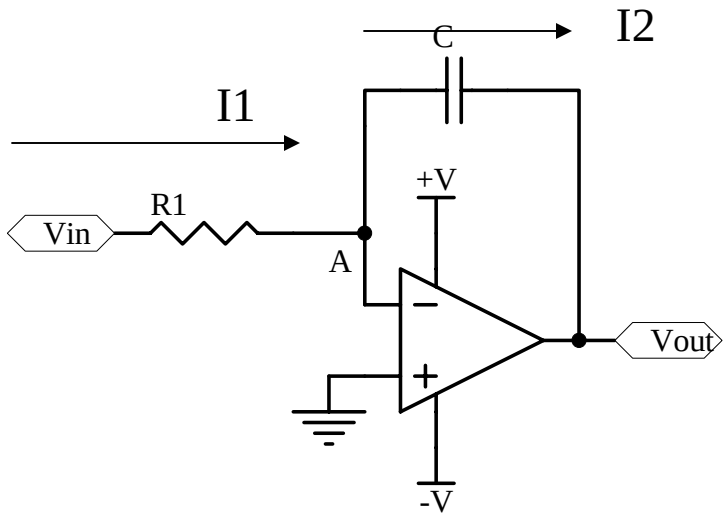
- Vout = +V apabila V (non-inverting)>V (inverting)
- Vout = -V apabila V (non-inverting)<V (inverting)

Rangkaian Buffer



- Vout = Vin
- Berfungsi untuk menurunkan impedansi sinyal

Rangkaian Integrator



I1 = I2

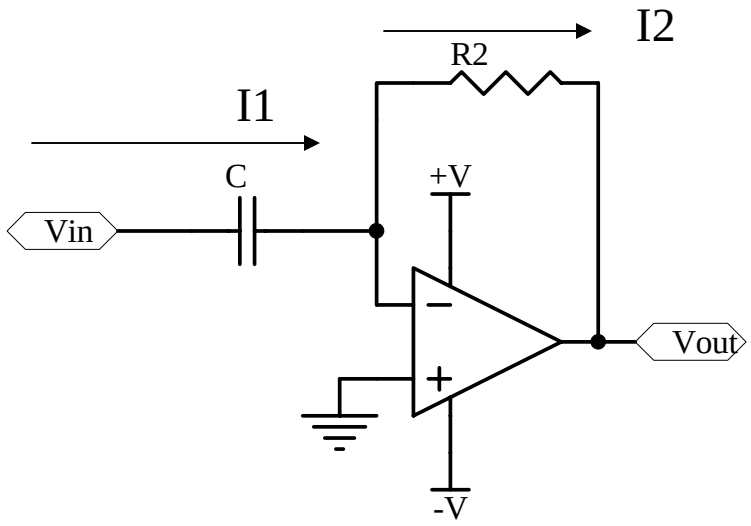
I1 = Vin / R1

I2 = C dVc/dt, dimana Vc = -Vout

C dVout/dt = Vin / R1

Vout = 1/RC $\int$ Vin

Rangkaian Differensiator



I1 = I2

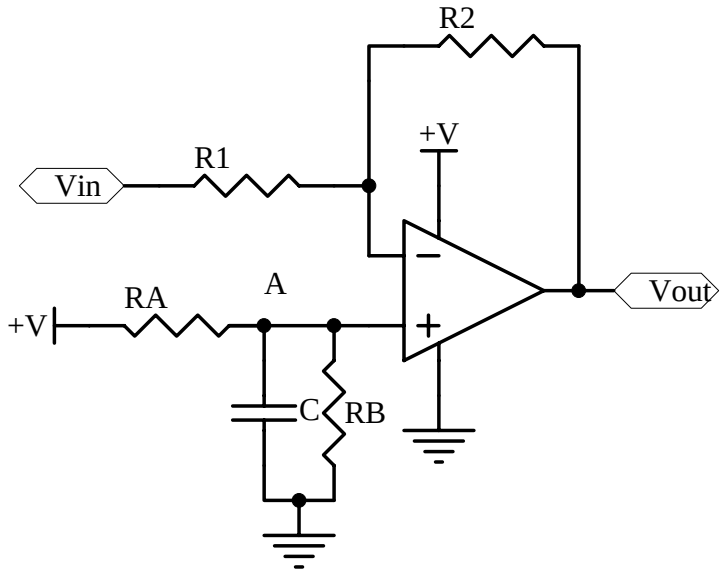
I1 = C dVc/dt, dimana Vc = Vin

Sehingga, I1= C dVin/dt

I2 = - Vout / R2

Vout = - RC dVin/dt

Power Supply Tunggal



- VA = virtual ground, diambil biasanya sebesar ½ V+, dengan cara memberika RA=RB