Realistic Amplifies Common Mode Rejection

① v_1 has a different Amplification factor from v_2

Thus $v_o = (A_1 v_1 - A_2 v_2)$ rather than

$A(v_1 - v_2)$

$$= A_1\left(\frac{v_1 - v_2}{2} + \frac{v_1 + v_2}{2}\right) + A_2\left(+\left(\frac{v_1 - v_2}{2}\right) - \left(\frac{v_1 + v_2}{2}\right)\right)$$

$v_1 - v_2 = v_{dif}$; $\frac{v_1 + v_2}{2} = v_{cm}$

$$v_o = \underbrace{\frac{(A_1 + A_2)}{2} v_{dif}}_{\text{Differential Mode Amplification} = A_d v_{dif}} + \underbrace{(A_1 - A_2) v_{cm}}_{\text{Common Mode Amplification } A_{cm} v_{cm}}$$

Common mode rejection ratio

$$CMRR = 20 \lg \left| \frac{A_d}{A_{cm}} \right| \quad \text{(pge 554)}$$

Example page 554 Electro cardiograph

$A_d = 1000$

$v_{dif} = 1\,mV$ $v_{cm} = 100\,V$ (60 Hz)

Output of cm to be 1% of dif. Thus

$.01\,mV \times 1000 = 10\,mV = 10^{-2}\,V$. Thus $A_{cm} = \frac{10^{-2}\,V}{100\,V}$

$= 10^{-4}$

$$CMRR = 20 \log \frac{1000}{10^{-4}} = 20 \times 7 = 140\,dB$$