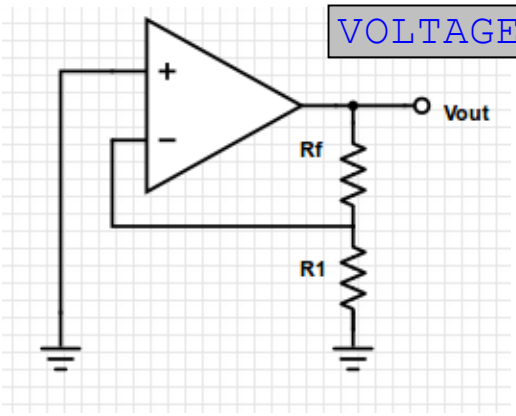
VOLTAGE ERROR DUE TO INPUT OFFSET VOLTAGE



$R_f := 35.11\ k\Omega$

$R_1 := 75\ k\Omega$

$R_p := \frac{1}{\left(\frac{1}{R_f} + \frac{1}{R_1}\right)}$ $R_p = 23914.7216\Omega$

$G_I := \left(\frac{R_f}{R_1}\right)$ Inverting Gain $G_I = 0.4681$

$G_{NI} := \left(\frac{R_f}{R_1} + 1\right)$ Non-Inverting Gain $G_{NI} = 1.4681$

$$\text{Initial} := \begin{pmatrix} \text{Vos} & \text{Ib} & \text{Ios} & \\ 60\ \mu V & 2.8\ nA & 2.8\ nA & \text{OPA177} \\ 100\ \mu V & 200\ pA & 150\ pA & \text{AD706} \end{pmatrix}$$

AD706 has higher offset but much lower bias and offset currents

$$TC := \begin{pmatrix} 1.2\ \frac{\mu V}{^\circ K} & 60\ \frac{pA}{^\circ K} & 85\ \frac{pA}{^\circ K} & \text{OPA177} \\ 1.5\ \frac{\mu V}{^\circ K} & 0.3\ \frac{pA}{^\circ K} & 0.6\ \frac{pA}{^\circ K} & \text{AD706} \end{pmatrix}$$

AD706 has worse Vos change due to temperature, but 2 orders of magnitude better bias and offset current stability

$T_{rise} := 20\ ^\circ K$

$$T_{rise} \cdot TC = \begin{pmatrix} \text{Vos} & \text{Ib} & \text{Ios} & \\ 2.4 \cdot 10^{-5}\ \frac{kg\ m^2}{A\ s^3} & 1.2 \cdot 10^{-9}\ A & 1.7 \cdot 10^{-9}\ A & \text{OPA177} \\ 3 \cdot 10^{-5}\ \frac{kg\ m^2}{A\ s^3} & 6 \cdot 10^{-12}\ A & 1.2 \cdot 10^{-11}\ A & \text{AD706} \end{pmatrix}$$

$$\text{Initial} + T_{rise} \cdot TC = \begin{pmatrix} 8.4 \cdot 10^{-5}\ \frac{kg\ m^2}{A\ s^3} & 4 \cdot 10^{-9}\ A & 4.5 \cdot 10^{-9}\ A & \text{OPA177} \\ 0.00013\ \frac{kg\ m^2}{A\ s^3} & 2.06 \cdot 10^{-10}\ A & 1.62 \cdot 10^{-10}\ A & \text{AD706} \end{pmatrix}$$

OPA177
Total Vout Error due to initial offsets, bias and gain

$V_{os} := 60\ \mu V$ $I_b := 2.8\ nA$ $I_{os} := 2.8\ nA$

$V_{Eos} := \left(V_{os} + I_b \cdot R_p\right) \cdot G_{NI}$ $V_{Eib} := I_b \cdot R_p \cdot G_{NI}$ $V_{Eios} := I_{os} \cdot R_p \cdot G_{NI}$

$V_{Eos} = 0.000186\ V$ $V_{Eib} = 0.000098\ V$ $V_{Eios} = 0.000098\ V$

Maximum total output voltage error

$V_{Eos} + V_{Eib} + V_{Eios} = 0.000383\ V$

RMS Error

$\sqrt{V_{Eos}^2 + V_{Eib}^2 + V_{Eios}^2} = 0.000233\ V$

OPA177
Change in Vout due to 20C temp rise

$T_{rise} := 20\ °K$

$V_{os} := TC_{1\,1} \cdot T_{rise}$ $I_b := TC_{1\,2} \cdot T_{rise}$ $I_{os} := TC_{1\,3} \cdot T_{rise}$

$V_{Eos} := \left(V_{os} + I_b \cdot R_p\right) \cdot G_{NI}$ $V_{Eib} := I_b \cdot R_p \cdot G_{NI}$ $V_{Eios} := I_{os} \cdot R_p \cdot G_{NI}$

$V_{Eos} = 0.000077\ V$ $V_{Eib} = 0.000042\ V$ $V_{Eios} = 0.000060\ V$

Maximum total output voltage error

$V_{Eos} + V_{Eib} + V_{Eios} = 0.000179\ V$

RMS Error

$\sqrt{V_{Eos}^2 + V_{Eib}^2 + V_{Eios}^2} = 0.000106\ V$

OPA177
Change in Vout due to 5C temp rise

$T_{rise} := 5\ °K$

$V_{os} := TC_{1\,1} \cdot T_{rise}$ $I_b := TC_{1\,2} \cdot T_{rise}$ $I_{os} := TC_{1\,3} \cdot T_{rise}$

$V_{Eos} := \left(V_{os} + I_b \cdot R_p\right) \cdot G_{NI}$ $V_{Eib} := I_b \cdot R_p \cdot G_{NI}$ $V_{Eios} := I_{os} \cdot R_p \cdot G_{NI}$

$V_{Eos} = 0.000019\ V$ $V_{Eib} = 0.000011\ V$ $V_{Eios} = 0.000015\ V$

Maximum total output voltage error

$V_{Eos} + V_{Eib} + V_{Eios} = 0.000045\ V$

RMS Error

$\sqrt{V_{Eos}^2 + V_{Eib}^2 + V_{Eios}^2} = 0.000027\ V$

AD706
Total Vout Error due to initial offsets, bias and gain

$V_{os} := 100\ \mu V$ $I_b := 200\ pA$ $I_{os} := 150\ pA$

$V_{Eos} := \left(V_{os} + I_b \cdot R_p\right) \cdot G_{NI}$ $V_{Eib} := I_b \cdot R_p \cdot G_{NI}$ $V_{Eios} := I_{os} \cdot R_p \cdot G_{NI}$

$V_{Eos} = 0.000154\ V$ $V_{Eib} = 7.022000 \cdot 10^{-6}\ V$ $V_{Eios} = 5.266500 \cdot 10^{-6}\ V$

Maximum total output voltage error

$V_{Eos} + V_{Eib} + V_{Eios} = 0.000166\ V$

RMS Error

$\sqrt{V_{Eos}^2 + V_{Eib}^2 + V_{Eios}^2} = 0.000154\ V$

AD706
Change in Vout due to 20C temp rise

$T_{rise} := 20\ °K$

$V_{os} := TC_{2\,1} \cdot T_{rise}$ $I_b := TC_{2\,2} \cdot T_{rise}$ $I_{os} := TC_{2\,3} \cdot T_{rise}$

$V_{Eos} := \left(V_{os} + I_b \cdot R_p\right) \cdot G_{NI}$ $V_{Eib} := I_b \cdot R_p \cdot G_{NI}$ $V_{Eios} := I_{os} \cdot R_p \cdot G_{NI}$

$V_{Eos} = 4.425466 \cdot 10^{-5}\ V$ $V_{Eib} = 2.1066 \cdot 10^{-7}\ V$ $V_{Eios} = 4.2132 \cdot 10^{-7}\ V$

Maximum total output voltage error

$V_{Eos} + V_{Eib} + V_{Eios} = 0.000045\ V$

RMS Error

$\sqrt{V_{Eos}^2 + V_{Eib}^2 + V_{Eios}^2} = 0.000044\ V$

AD706
Change in Vout due to 5C temp rise

$T_{rise} := 5\ °K$

$V_{os} := TC_{2\,1} \cdot T_{rise}$ $I_b := TC_{2\,2} \cdot T_{rise}$ $I_{os} := TC_{2\,3} \cdot T_{rise}$

$V_{Eos} := \left(V_{os} + I_b \cdot R_p\right) \cdot G_{NI}$ $V_{Eib} := I_b \cdot R_p \cdot G_{NI}$ $V_{Eios} := I_{os} \cdot R_p \cdot G_{NI}$

$V_{Eos} = 1.106367 \cdot 10^{-5}\ V$ $V_{Eib} = 5.2665 \cdot 10^{-8}\ V$ $V_{Eios} = 1.0533 \cdot 10^{-7}\ V$

Maximum total output voltage error

$V_{Eos} + V_{Eib} + V_{Eios} = 0.000011\ V$

RMS Error

$\sqrt{V_{Eos}^2 + V_{Eib}^2 + V_{Eios}^2} = 0.000011\ V$