

b) $U_{ref} = -10V \quad N_o = 10^9$

$U_{in} = 5.8V$

$N_o U_{in} = N_m U_{ref}$

$N_m = 5800$

c) $f_{sum} = 50\text{Hz}$

$f_{osc} = N_o - f_{sum} = 5004\text{Hz}$

$$\frac{N_m}{f_{osc}} = t_m$$

$$\frac{N_o}{f_{osc}} = t_0$$

d) $f_s = \frac{1}{t_0} + \frac{1}{t_m} = \frac{f_{osc}}{N_o} + \frac{f_{osc}}{N_m} = 136.2\text{Hz}$

② $f_s = 400 \text{ kHz}$

$$f_d = ?$$

$$n = 16 \text{ bits}$$

$$\underline{\text{SNR} = 140 \text{ dB}}$$

SNR w/ noise $\Sigma \Delta = ?$

$$\text{SNR} = 6,02 n - 3,41 + 30 \log \frac{f_s}{2f_d}$$

$$140 - 6,02 - 16 + 3,41 = 30 \log \frac{f_s}{2f_d}$$

$$47,09 = 30 \log \frac{f_s}{2f_d}$$

$$37,125 = \frac{400 \text{ kHz}}{2f_d}$$

$$\boxed{f_d = 5387,2 \text{ Hz}}$$

Ran lotje mije $\Sigma \Delta$:

$$\text{SNR} = 6,02 \cdot n + 1,76$$

$$\boxed{\text{SNR} = 98,08 \text{ dB}}$$

(3)

$$u(t) = 3V \cdot \sin(2\pi \cdot 576 \text{ Hz} \cdot t - 34^\circ) + 0,2 \sin(2\pi \cdot 576 \text{ Hz} \cdot t + 54^\circ) \\ + 1V \sin(2\pi \cdot 657 \text{ Hz} \cdot t + 65^\circ)$$

LIA propuesta figura de amplitud [567 Hz]

$$U_{imp} = \frac{1}{2} U_0 \sin \varphi = \frac{3}{2} \sin(34^\circ) + 0,1 \sin(54^\circ) = 0,9197$$

$$U_Q = \frac{1}{2} U_0 \cos \varphi = \frac{3}{2} \cos(34^\circ) + 0,1 \cos(54^\circ) = 1,30233$$

$$\frac{1}{2} \cdot 3 \cos \left(2\pi \cdot 576 \text{ Hz} \cdot t + 34^\circ - 2\pi \cdot 576 \text{ Hz} \cdot t \right) \\ = \frac{3}{2} \cos(34^\circ)$$

$$\frac{1}{2} \cdot 0,2 \cos \left(2\pi \cdot 576 \text{ Hz} \cdot t + 54^\circ - 2\pi \cdot 576 \text{ Hz} \cdot t \right) \\ = 0,1 \cos(54^\circ)$$

$$(4) \quad u_p^2 = 1,69 \cdot 10^{-16} \text{ V}^2/\text{Hz}$$

$$i_p^2 = 1 \cdot 10^{-26} \text{ A}^2/\text{Hz}$$

$$u_{M,12}^2 = 1 \cdot 10^{-19} \text{ V}^2/\text{Hz}$$

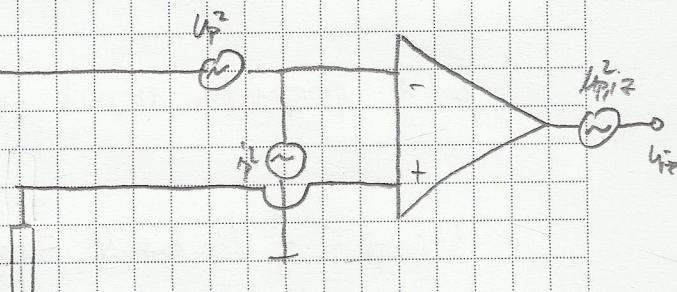
$$A \cdot \Delta f = 12 \text{ MHz}$$

$$A = 1000$$

$$M = 16 \text{ Giga}$$

$$U_{FS} = 5 \text{ V}$$

$$u_{M,PP} = ? \quad \Delta M = ?$$



$$R_{M1} = R_1 R_2 = \frac{350 \cdot 350}{700} = 175 \Omega$$

12.6 Hz

$$u_{M,12}^2 = (u_p^2 + i_p^2 \cdot R_{M1}^2) \cdot A \Delta f + u_{p,12}^2 \Delta f = \\ = 2,148 \cdot 10^{-9} \text{ V}^2$$

$$u_{M,12,SE} = \sqrt{2,148 \cdot 10^{-9}} = 4,63465 \cdot 10^{-5} \text{ V}_{eff}$$

$$u_{M,PP} = 6 \cdot u_{M,12,SE} = 0,1278 \text{ mV}_{pp}$$

$$LSB = \frac{5 \text{ V}}{2^{16}} = \frac{5}{65536} \text{ V}$$

$$LSB = \frac{u_{M,PP}}{2^{\Delta M}} \quad 2^{\Delta M} = \frac{u_{M,PP}}{LSB} \quad | \log_2$$

$$\Delta M = \log_2 \frac{u_{M,PP}}{LSB} = 1,86546$$

4 biti maxima un 2 bita