Audiotehnika

1. MI – A grupa

① Nelinearno harmonička izobličenja su ona izobličenja koja će generirati samo harmonike osnovnog signala. Ta izobličenja nastaju zbog nelinearne prijenosne karakteristike

Mjerenje:

- mjerimo razine harmonika i osnovnog harmonika
- uspoređujemo ih (računamo THD)

$$THD = \frac{\sqrt{U_1^2 + U_2^2 + U_3^2 + \dots}}{\sqrt{U_0^2 + U_1^2 + U_3^2 + U_4^2 + \dots}} \cdot 100\%$$

THD (Total Harmonic Distortion) – odnos harmonijskih harmonika u odnosu na sve harmonike

$f = 1\,kHz$

$k = ?$

$$0\,dBV = 20 \log \frac{U_0}{1V}$$

$$0\,dBV = \log \frac{U_0}{1V}$$

$$\frac{U_0}{1V} = 1$$

$U_0 = 1V$ – osnovni sig

$$-20\,dBV = 20 \log \frac{U_1}{1V}$$

$$-1\,dBV = \log \frac{U_1}{1V}$$

$$\frac{U_1}{1V} = 10^{-1}$$

$U_1 = 0.1V$ – 2. harmonik ($2\,kHz$)

$$-30\,dBV = 20 \log \frac{U_3}{1V}$$

$$-\frac{3}{2}\,dBV = \log \frac{U_3}{1V}$$

$$\frac{U_3}{1V} = 10^{-\frac{3}{2}}$$

$U_3 = 0.0316V$ – 4. harmonik ($4.\,kHz$)

$$THD = \frac{\sqrt{U_1^2 + U_3^2}}{\sqrt{U_0^2 + U_1^2 + U_3^2}} \cdot 100\% = \frac{\sqrt{0.1^2 + 0.0316^2}}{\sqrt{1^2 + 0.1^2 + 0.0316^2}} \cdot 100\%$$

$$THD = 10.43\%$$

② $U = \pm 45\,V \Rightarrow$ treba biti efektivna vrijednost (valjda)

$U_{šum\,ef} = 10\,mV \Rightarrow$

Odnos signal-šum - odnos između max. razine signala i razine šuma

$$S/N = 20 \log\left(\frac{U_{MAX}}{U_{šum}}\right) = 20 \log\left(\frac{45 \cdot \frac{1}{\sqrt{2}}}{10 \cdot 10^{-3}}\right) = 70.050\,dB$$

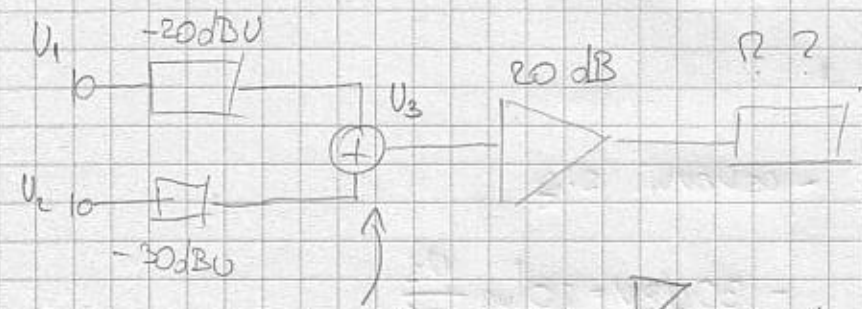
Dinamika pojačala

- odnos razine šuma i max. razine, ali sa maksimalnim harmonijskim izobličenjima manjim od 1% (THD < 1%)

$THD < 1 \rightarrow 25\,V$

$$S/N = 20 \log\left(\frac{25}{10 \cdot 10^{-3}}\right) = 67.95\,dB$$

③



ne zbrajati decibele ⚡ pretvoriti u napone

$$-20\,dBU = 20 \log \frac{U_1}{0.775\,V_{ef}} \qquad -30\,dBu = 20 \log \frac{U_2}{0.775\,V_{ef}}$$

$$U_1 = 10^{-1} \cdot 0.775 = 77.5\,mV \qquad U_2 = 10^{-\frac{3}{2}} \cdot 0.775 = 24.5\,mV$$

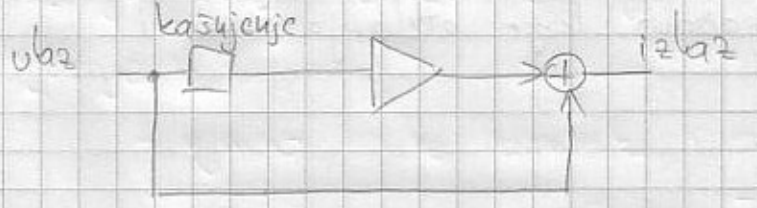
$$U_3 = U_1 + U_2 = 102\,mV$$

$$U_2[dBV] = 20 \lg \frac{102 \cdot 10^{-3}}{0,775} = -17.61 \; dBV$$

$$U_{i2} = 20 - 17.61 = 2.38 \; dBV$$

④

Kašnjenje - delay



- efekti koji se baziraju - Chorus - modelira se vrijeme kašnjenja
  - Flanger - kratko kašnjenje (1-10 ms)
  - Echo
  - Slapback

$f = 1 kHz \rightarrow T = \frac{1}{f} = 1 ms$

$U = 1V$

$t = 0.5 ms$

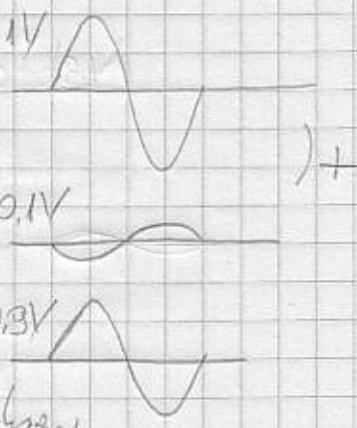
$A = -20 dB$

$U_{i2} = ?$

$-20dB = 20 \lg \frac{U_2}{1}$

$U_2 = 10^{-1} = 0.1V$

$U_{i2} = U_1 - U_2 = 0.9V$



Ja sam to shvatil da vedino imamo sin. signal na ulazu
Pa ga smanjimo i pomaknemo za pola perioda i zbrojimo s originalnim
Valjda se mora i tak gledat ??

⑤ To još nismo radili

⑥

Balansirani signal – signal bez šuma i smetnji

Kroz treći kabel prenosimo signal i taj isti signal suprotnog ufaza.

Na izlazu je diferencijalno pojačalo koje otklanja šumu i zbraja signal

$$\begin{matrix} U_0 + U_š \\ -U_0 + U_š \end{matrix} \rightarrow \text{dif. poj.} \quad U_0 + U_š - (-U_0 + U_š) = 2U_0$$