1. Primjer

$u_x = u_{DV}$

$$u_c(u_x) = \sqrt{\sum_{i=1}^{N} \left(\frac{\partial f}{\partial x_i}\right)^2 u^2(x_i)}$$

$$u_c(u_x) = \sqrt{u^2(u_{DV})}$$

$$u_c(u_x) = \sqrt{u_A^2(u_{DV}) + u_B^2(u_{DV})}$$

$$u_A(u_{DV}) = s(\overline{u_{DV}}) = \frac{s(u_{DV})}{\sqrt{n}} = \frac{9,55mV}{\sqrt{15}} = 2,44mV$$

$$u_B(u_{DV}) = \frac{G_1}{\sqrt{3}} = \frac{2,88mV}{\sqrt{3}} = 1,66mV$$

$$G_1 = \pm\left(14\cdot 10^{-5}\cdot \overline{u_{DV}} + 17\cdot 10^{-5}\cdot 10V\right)$$

$$= \pm 2,88mV \rightarrow a = 2,88mV$$

$$u_c(u_x) = \sqrt{(2,44mV)^2 + (1,66mV)^2} = 2,95mV$$

$$u_p = k_p \cdot u_c(y) = t_p(V_{efekt}) \cdot u_c(y)$$

$$V_{efekt} = \frac{u_c^4(y)}{\sum_{i=1}^{N}\left[\frac{u_c^4(y)}{\nu_i}\right]}$$

$V_A = n-1$ → stupanj slobode

$V_B = \infty$

$$V_{efk} = \frac{u_c^4(u_{DV})}{\frac{u_A^4(u_{DV})}{\nu_A} + \frac{u_B^4(u_{DV})}{\nu_B}} = \frac{(2,95mV)^4}{\frac{(2,44mV)^4}{14} + \frac{(1,66mV)^4}{\infty}}$$

$V_{efk} = 30,02 \simeq 30$

↳ prvi manji cijeli broj

↓

stupanj slobode

$t_p(V_{efk}) = (30;\ p=95\%) = 2,04$

$u_p = 2,04 \cdot 2,95mV = \underline{6,02mV}$ //

2. Primjer

I način

$P = U \cdot I$

$P = 92\,W$

$$u_c(P) = \sqrt{\sum_{i=1}^{N} \left(\frac{\partial f}{\partial x_i}\right)^2 \cdot u^2(x_i)}$$

$$u_c(P) = \sqrt{\left(\frac{\partial P}{\partial U}\right)^2 \cdot u^2(U) + \left(\frac{\partial P}{\partial I}\right)^2 \cdot u^2(I)}$$

$$u_c(P) = \sqrt{I^2 \cdot u^2(U) + U^2 \cdot u(I)}$$

$$u_c(P) = \sqrt{(0{,}8\,A)^2 \cdot (0{,}115\,V)^2 + (115\,V)^2 \cdot (0{,}002\,A)^2} = 0{,}25\,W$$

$u_r \rightarrow$ Urelativno

$$u_r = \frac{u(x_i)}{x_i} \cdot 100\,\%$$

$$u(x_i) = \frac{u_r(\%) \cdot x_i}{100\,\%}$$

$$u(U) = \frac{0{,}1 \cdot 115\,V}{100\,\%} = 0{,}115\,V$$

$$u(I) = \frac{0{,}25 \cdot 0{,}8}{100\,\%} = 0{,}002\,A$$

II način

$P = U \cdot I \quad (c = 1, P_1 = 1, P_2 = 1)$ 18/33 slajd ▽

$$u_{cr}(P) = \sqrt{[1 \cdot u_r^2(V)] + [1 \cdot u_r^2(I)]}$$

$$u_{cr\%}(P) = \sqrt{u_{r\%}^2(V) + u_{r\%}^2(I)} = \sqrt{(0{,}1)^2 + (0{,}25)^2}$$

$u_{cr\%}(P) = 0{,}27\,\%$

$$u_c(P) = \frac{u_{cr\%}(P) \cdot P}{100\,\%}$$

$$u_{cr\%}(P) = \frac{u_c(P)}{P} \cdot 100\,\%$$

$$u_c(P) = \frac{0{,}27 \cdot 92\,W}{100} = 0{,}25\,W$$

$R = \frac{U}{I}$ $\quad u_{cr\%}(R) = \sqrt{u_{r\%}^2(U) + u_{r\%}(I)}$ → 2a. $P = U \cdot I$ ali $R = \frac{U}{I}$

III način

$P = I^2 \cdot R$ $\quad (P_1 = 2, P_2 = 1, c = 1)$ → složljivi!

$\overset{\circ}{2}^2$

$u_{cr\%}(P) = \sqrt{4 \cdot u_{r\%}^2(I) + u_{r\%}^2(R)}$

Izvod 2a $u_{cr\%}(P)$

$$u_c(P) = \sqrt{\left(\frac{\partial P}{\partial I}\right)^2 \cdot u^2(I) + \left(\frac{\partial P}{\partial R}\right)^2 \cdot u^2(R)}$$

$$u_c(P) = \sqrt{(2 \cdot I \cdot R)^2 \cdot u^2(I) + (I^2)^2 \cdot u^2(R)}$$

$$u_{cr\%} = \frac{u_c(P)}{P} \cdot 100\%$$

$$u_{cr\%}(P) = \sqrt{\frac{4 I^2 R^2 \cdot u^2(I)}{I^4 R^2} (100\%)^2 + \frac{I^4 u^2(R)}{I^4 \cdot R^2} \cdot (100\%)^2}$$

$$u_{cr\%}(P) = \sqrt{4 \left[\frac{u(I)}{I} \cdot 100\%\right]^2 + \left[\frac{u(R)}{R} \cdot 100\%\right]^2}$$

I dalje izvodi

$$R_{uk} = R_1 \pm R_2$$

$$u_c(R_{uk}) = \sqrt{\left(\frac{\partial R_{uk}}{\partial R_1}\right)^2 \cdot u^2(R_1) + \left(\frac{\partial R_{uk}}{\partial R_2}\right)^2 \cdot u^2(R_2)}$$

$$u_c(R_{uk}) = \sqrt{u^2(R_1) + u^2(R_2)}$$

$$u_{kr}(R_{uk}) = \frac{u_c(R_{uk})}{R_{uk}} \cdot 100\,\% = \frac{\sqrt{u^2(R_1) + u^2(R_2)}}{R_1 + R_2} \cdot 100\,\%$$

Mjerenje gubitaka

3. primjer

$$u_{r\%}(P_{ul}) = \frac{u(P_{ul})}{P_{ul}} \cdot 100\,\% = 0{,}77\,\%$$

$$u_{r\%}(P_{iz}) = \frac{u(P_{iz})}{P_{iz}} \cdot 100\,\% = 0{,}67\,\%$$

$$P_g = P_{ul} - P_{iz}$$

$$u_c(P_g) = \sqrt{u^2(P_{ul}) + u^2(P_{iz})} = \sqrt{(2{,}7\,W)^2 + (2{,}1\,W)^2} = 3{,}42\,W$$

$$u_{cr\%}(P_g) = \frac{u_c(P_g)}{P_g} \cdot 100\,\% = \frac{3{,}42\,W}{40\,W} \cdot 100\,\% = 8{,}55\,\%$$