NN 21 — 13. lipnja 2011.

① $\varphi_A = 50\ kV$
$\varphi_2 = 52.74\ kV$
$\varphi_3 = 60.28\ kV$
$\varphi_6 = 31.59\ kV$
$\varphi_7 = 9.5\ kV$

$\varphi_1 = \frac{1}{4}(\varphi_A + \varphi_2 + 0 + 100) = \frac{1}{4}(50 + 52.74 + 100) = 50.62\ kV$

$\varphi_4 = \frac{1}{4}(\varphi_3 + \varphi_6 + \varphi_3 + 100) = \frac{1}{4}(60.28 + 31.59 + 60.28 + 100) = 63.04\ kV$

$\varphi_5 = \frac{1}{4}(\varphi_3 + \varphi_6 + \varphi_7) = \frac{1}{4}(60.28 + 31.59 + 9.5) = 25.34\ kV$

$\varphi_8 = \frac{1}{4}(\varphi_6 + 2\varphi_7) = \frac{1}{4}(31.59 + 29.5) = 12.65\ kV$

$\varphi_9 = \frac{1}{4}(\varphi_A + \varphi_1 + 2\cdot 100) = \frac{1}{4}(50 + 50.62 + 200) = 75.16\ kV$

$\varphi_{10} = \frac{1}{4}(\varphi_1 + \varphi_2 + 200) = 75.84\ kV$ $\varphi_{11} = \frac{1}{4}(\varphi_2 + \varphi_3 + 2\cdot 100) = 78.26\ kV$

$\varphi_{12} = \frac{1}{4}(\varphi_4 + \varphi_3 + 200) = 80.83\ kV$ $\varphi_{13} = \frac{1}{4}(\varphi_A + \varphi_1) = 25.16\ kV$

$\varphi_{14} = \frac{1}{4}(\varphi_1 + \varphi_2) = 25.84\ kV$ $\varphi_{15} = \frac{1}{4}(\varphi_2 + \varphi_3 + \varphi_5) = 34.59\ kV$

$\varphi_{16} = \frac{1}{4}(\varphi_3 + \varphi_4 + \varphi_5 + \varphi_6) = 45.06\ kV$ $\varphi_{17} = \frac{1}{4}(\varphi_5 + \varphi_7) = 8.71\ kV$

$\varphi_{18} = 19.77\ kV$ $\varphi_{19} = 2.38\ kV$ $\varphi_{20} = 5.54\ kV$

② $U_0 = 360\ kV$
$T = 6\mu s$
$T = 2\mu s$
$l = 340\ m$
$v = 170\ m/\mu s$
$Z_1 = 380\ \Omega$
$Z_2 = 50\ \Omega$
$V_p = 60\ kV$
$\Delta t = 2\mu s$

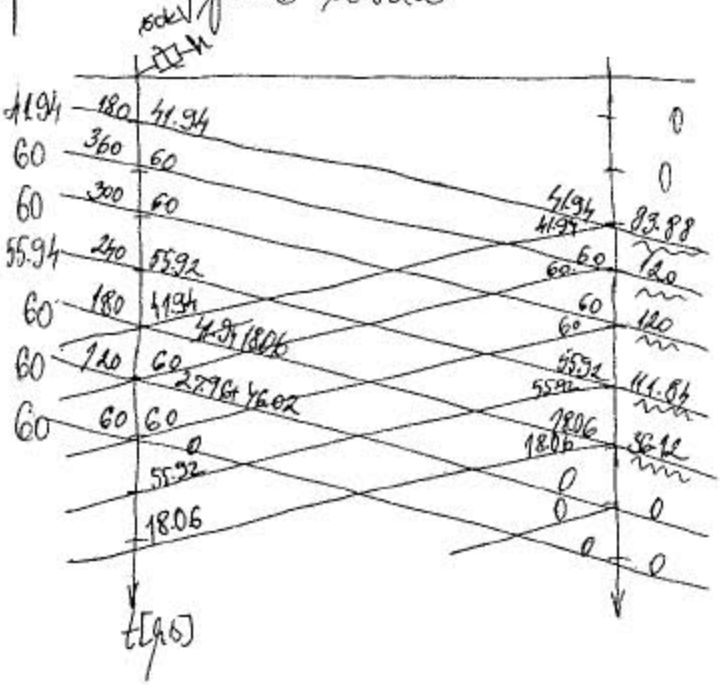
$v = \frac{l}{t} \Rightarrow t = \frac{340}{170} = 2\mu s$ → vrijeme prolaska preko žbice

$\mu_{12} = \frac{2Z_2}{Z_1 + Z_2} = 0.233$ $r_{12} = \mu_{12} - 1 = -0.767$

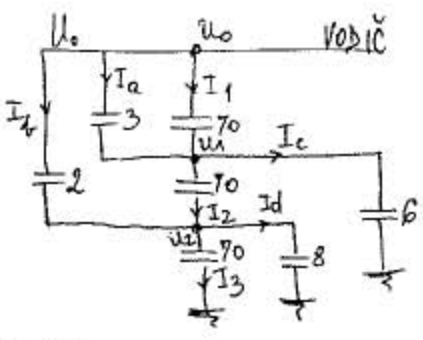
$\mu_{23} = \frac{2Z_T}{Z_1 + Z_T} \approx 2$ $r_{23} = 1$

$\mu_{21} = \frac{2Z_1}{Z_1 + Z_2} = 1.767$ $r_{21} = 0.767$

$u(0) = 0$
$u(1) = 180\ kV$
$u(2) = 360\ kV$
$u(3) = 300\ kV$
$u(4) = 240\ kV$
$u(5) = 180\ kV$
$u(6) = 120\ kV$
$u(7) = 60\ kV$
$u(8) = 0$



③ $C_1 = 70\ \mu F$
$C_a = 3\ \mu F$
$C_b = 2\ \mu F$
$C_c = 6\ \mu F$
$C_d = 8\ \mu F$



$\begin{cases} I_1 + I_a = I_2 + I_c \\ I_2 + I_b = I_3 + I_d \end{cases}$

$\begin{cases} \frac{u_0 - u_1}{Z_1} + \frac{u_0 - u_1}{Z_a} = \frac{u_1 - u_2}{Z_1} + \frac{u_1}{Z_c} \\ \frac{u_0 - u_2}{Z_b} + \frac{u_1 - u_2}{Z_1} = \frac{u_2}{Z_d} + \frac{u_2}{Z_1} \end{cases}$

$\begin{cases} 70\cdot(35 - u_1) + 3(35 - u_1) = 70(u_1 - u_2) + 6u_1 \\ 2\cdot(35 - u_2) + 70(u_1 - u_2) = 8u_2 + 70u_2 \end{cases}$

$\begin{cases} 73\cdot(35 - u_1) = 76u_1 - 70u_2 \\ 70 - 2u_2 + 70u_1 - 70u_2 = 78u_2 \end{cases}$

$\begin{cases} 73\cdot 35 = 149u_1 - 70u_2 \\ 70 = -70u_1 + 150u_2 \ / \cdot 2.129 \end{cases}$

$\Rightarrow u_2 = 10.84\ kV$
$u_1 = 22.24\ kV$

$\Delta u_1 = u_0 - u_1 = 12.76\ kV$
$\Delta u_2 = u_1 - u_2 = 11.40\ kV$
$\Delta u_3 = 10.84\ kV$

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① $\varphi_A = 25$ kV
$\varphi_2 = 26.37$ kV
$\varphi_3 = 30.14$ kV
$\varphi_6 = 15.80$ kV
$\varphi_7 = 4.75$ kV

$\varphi_1 = \frac{1}{4}(\varphi_A + \varphi_2 + 0 + 100) = 37.84$ kV

$\varphi_4 = \frac{1}{4}(\varphi_3 + \varphi_6 + \varphi_B + 100) = 44.02$ kV

$\varphi_5 = \frac{1}{4}(\varphi_3 + \varphi_6 + \varphi_7) = 12.67$ kV

$\varphi_8 = \frac{1}{4}(\varphi_6 + 2\varphi_7) = 6.325$ kV

$\varphi_9 = \frac{1}{4}(\varphi_4 + \varphi_1 + 2\cdot 100) = 65.71$ kV

$\varphi_{10} = 66.05$ kV $\varphi_{11} = 64.13$ kV $\varphi_{12} = 68.54$ kV

$\varphi_{13} = 15.71$ kV, $\varphi_{14} = 16.05$ kV $\varphi_{15} = 17.29$ kV

$\varphi_{16} = 25.66$ kV $\varphi_{17} = 4.35$ kV $\varphi_{18} = 5.88$

$\varphi_{19} = 1.19$ kV $\varphi_{20} = 2.77$ kV

② $U_0 = 360$ kV
$T_1 = 2\mu s$
$T_2 = 6\mu s$
$l = 320$ m
$v = 160$ m/μs
$Z_1 = 380\,\Omega$
$Z_2 = 50\,\Omega$
$U_p = 65$ kV

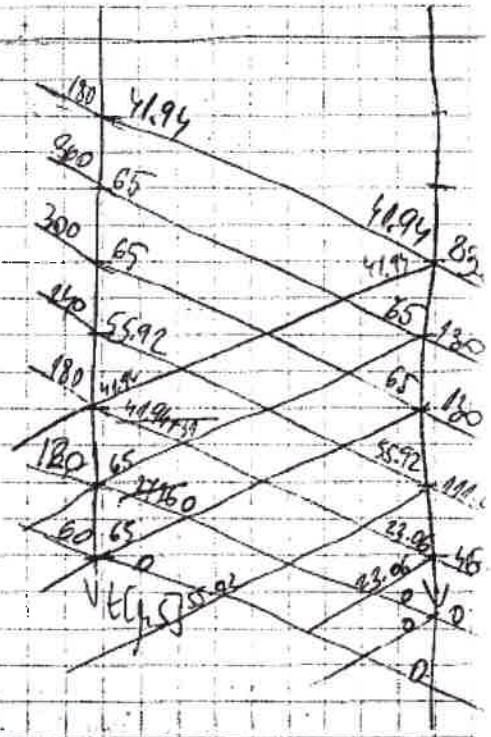
$v = \frac{l}{t} \Rightarrow t = \frac{320}{160} = 2\mu s$

$r_{12} = 0.233$ $r_{12} = 0.767$

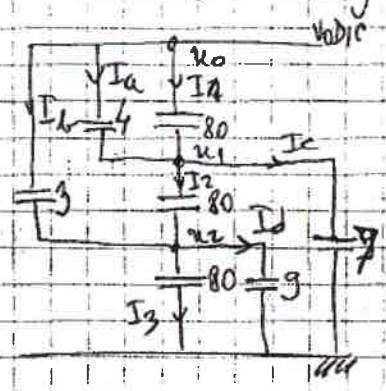
$r_{23} \approx 2$ $r_{23} \approx 1$

$r_{21} = 1.767$ $r_{21} = 0.767$

$u(0) = 0$ $u(5) = 180$ kV
$u(1) = 180$ kV $u(6) = 120$ kV
$u(2) = 360$ kV $u(7) = 60$ kV
$u(3) = 300$ kV $u(8) = 0$
$u(4) = 240$ kV



③ $C_1 = 80\,\mu F$
$C_{21} = 7\,\mu F$
$C_{22} = 9\,\mu F$
$C_{V1} = 4\,\mu F$
$C_{V2} = 3\,\mu F$



$$\begin{cases} I_a + I_1 = I_2 + I_c \\ I_b + I_2 = I_3 + I_d \end{cases}$$

$$\begin{cases} 4(u_0 - u_1) + 80(u_0 - u_1) = 80(u_1 - u_2) + 7u_1 \\ 3(u_0 - u_2) + 80(u_1 - u_2) = 80u_2 + 9u_2 \end{cases}$$

$$\begin{cases} 84(35 - u_1) = 87u_1 - 80u_2 \\ 3(35 - u_2) + 80(u_1 - u_2) = 89u_2 \end{cases}$$

$$\begin{cases} 84.35 = 171u_1 - 80u_2 \\ 105 = -80u_1 + 172u_2 \quad /\cdot 2.14 \end{cases}$$

$$+ \begin{cases} 80.35 = 171u_1 - 80u_2 \\ 105 \cdot 2.14 = -171u_1 + 172 \cdot 2.14 u_2 \end{cases}$$

$u_2 = 10.985$
$u_1 = 22.332$
$u_0 = 35$ kV

$\Delta u_1 = 12.66$ kV $\Delta u_3 = 10.$
$\Delta u_2 = 11.34$ kV