Jun 2015

Op 1

a) 50 cm

b) $v(t) \frac{V_0}{K} \frac{1}{\alpha_2 - \alpha_1} \left(e^{-\alpha_1 t} - e^{-\alpha_2 t} \right)$

$V_0 = 60kV$

$K = R_1 \cdot C_2$ So we need R_1

$$R_1 = \frac{1}{2 \cdot 1{,}2 \cdot 10^{-5}} \cdot \left[\left(68{,}2 \cdot 10^{-6} + 0{,}405 \cdot 10^{-6} \right) - \sqrt{\left(68{,}2 \cdot 10^{-6} + 0{,}405 \cdot 10^{-6} \right)^2 - \frac{4 \left(10 \cdot 10^{-5} + 1{,}2 \cdot 10^{-5} \right)}{\frac{1}{68{,}2 \cdot 10^{-6}} \cdot \frac{1}{0{,}405 \cdot 10^{-6}} \cdot 10 \cdot 10^{-5}}} \right] = 378\,\Omega$$

$K_1 = 378 \cdot 1{,}2 \cdot 10^{-9} = 453{,}9 \cdot 10^{-9}$

$\alpha_1 = \frac{1}{68{,}2 \cdot 10^{-6}} = 14663$

$\alpha_2 = \frac{1}{0{,}405 \cdot 10^{-6}} = 2469136$

$V(t) = \underbrace{132{,}2 \cdot 10^{6} \cdot 4{,}074 \cdot 10^{-7}}_{53{,}86} \left[e^{-14663 \cdot t} - e^{-2469136 \cdot t} \right]$

Grafens toppunkt ca $V_{max} = 51,9$ kV

$$\eta = \frac{57,9}{60} = \underline{86,5\ \%}$$

30 % = 15,6 $\Rightarrow$ $t = 137,6$ ns
90 % 46,7 $t = 851$ ns

$T = 851 - 137,6 \simeq 713$ ns

$T_1 = 1,67 \cdot 713 = \underline{1,19\ \mu s}$

50 % = 26 kV $\Rightarrow$

$T_2 \simeq \underline{50\ \mu s}$

ALL OK

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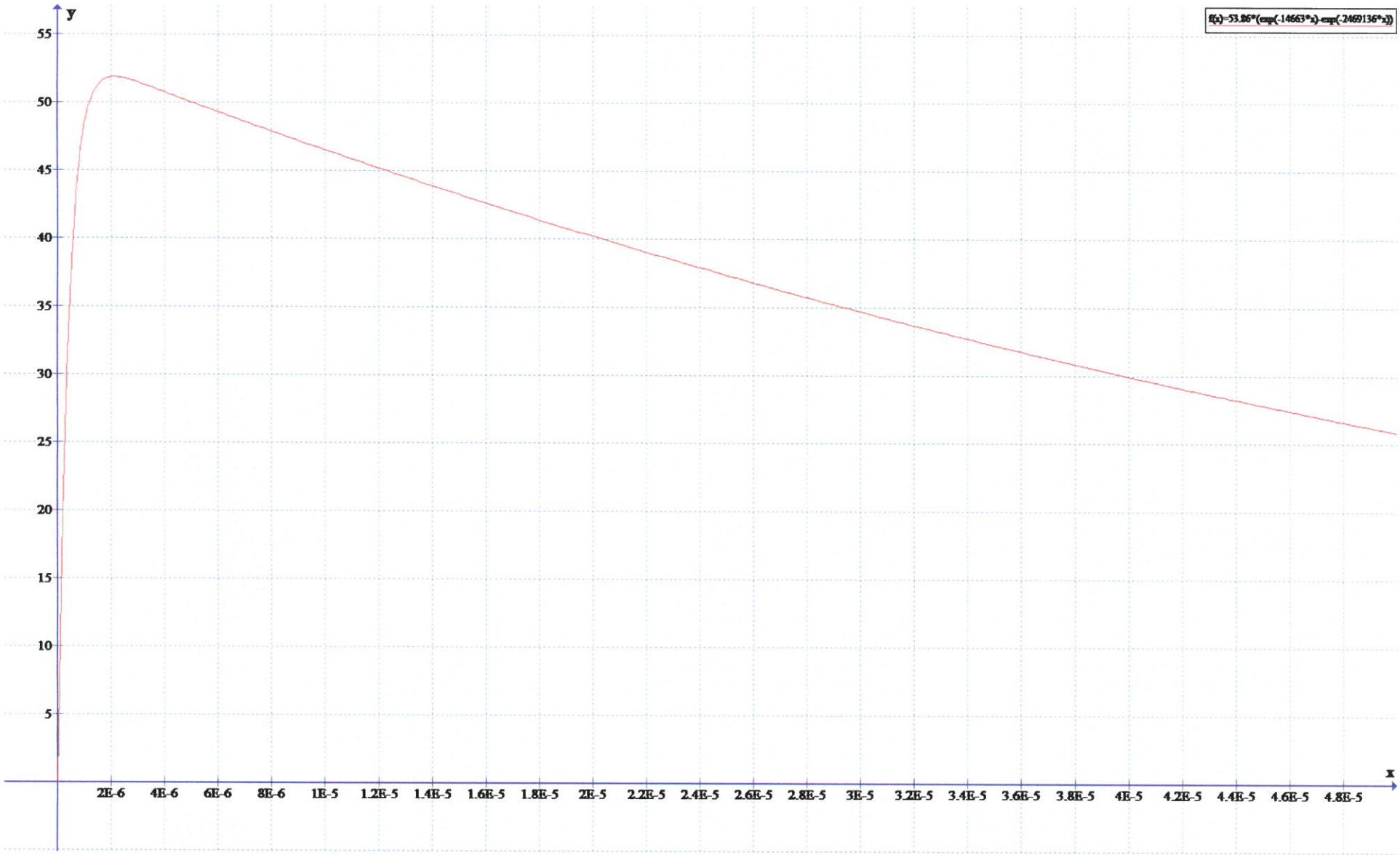
$V_{max} = 51,9$ kV $\Rightarrow$ 12,5 cm Sphere

15 mm $\Rightarrow$ 45,5 kV
20 mm $\Rightarrow$ 59,0 kV $\Rightarrow$ $\frac{59,0 - 45,5}{20 - 15} = 2,7\ kV/mm$

$\delta = \frac{1027}{1013} \frac{273 + 20}{273 + 25} \simeq 1,0$ så $V_d = V_{do}$

$51,9 - 45,5 = 6,4 \sim 2,37$ mm

$S = 15 + 2,37 = \underline{17,4\ mm}$


f(x)=53.86*(exp(-.14663*x)-exp(-.2469136*x))
y
55
50
45
40
35
30
25
20
15
10
5
x
2E-6
4E-6
6E-6
8E-6
1E-5
1.2E-5
1.4E-5
1.6E-5
1.8E-5
2E-5
2.2E-5
2.4E-5
2.6E-5
2.8E-5
3E-5
3.2E-5
3.4E-5
3.6E-5
3.8E-5
4E-5
4.2E-5
4.4E-5
4.6E-5
4.8E-5

4/

Opg 2

a) Ikke ikke

b) $\tan\delta = 0{,}156$

$\tan\delta_s = \omega R_s \cdot C_s$

$0{,}156 = 314 \cdot R_s \cdot 450 \cdot 10^{-9} \Rightarrow R_s = 1104\,\Omega$

$R_s \| \frac{1}{j\omega C_s} = 1104 - 7707\,\Omega$

$I = \frac{40 \cdot 10^3}{1104 - 7707} = \underline{5{,}58 \angle 81{,}1^\circ}\ A$

$P = 5{,}58^2 \cdot 1104 = \underline{34{,}4\,kW}$

c) $10 \cdot 10^3 = 5{,}58^2 \cdot R_s \Rightarrow 321{,}2\,\Omega \rightarrow$

$\tan\delta_{sns} = 314 \cdot 321{,}2 \cdot 450 \cdot 10^{-9} = \underline{0{,}0454}$

d) Spread over all of, small magnitude of even distribution $\Rightarrow$ Contact noise

e) Good condition, but fairly high dielectric losses.