0. Basic data :

$T := 300.15K$ $k := 1.38065 \cdot 10^{-23} V \cdot A \cdot s \cdot K^{-1}$ $B_{20k} := 19980Hz$ $B_1 := 1Hz$

$f := 1Hz, 2Hz .. 100kHz$ $B_{100k} := 99999Hz$ $B_{1k} := 999Hz$ $TOL := 10^{-18}$

succ-apps = succesive approximations, subscript s = simulated

1. Math simulation of the voltage noise density trace :

Guessed white noise level : $e_{n.wn} := 3.4 \cdot 10^{-9} V$

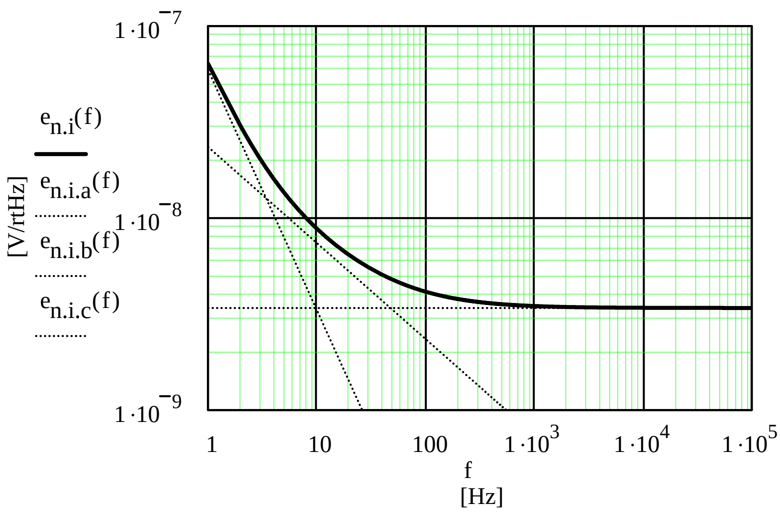
Succ-apps of the corner frequencies and slopes x & y leads to : $f_{c.e1} := 47.5Hz$ $f_{c.e3} := 9.8Hz$

$x := -1$ $y := -2.5$

Curve equation : $$e_{n.i}(f) := e_{n.wn} \cdot \sqrt{1 + \left(\frac{f}{f_{c.e1}}\right)^x + \left(\frac{f}{f_{c.e3}}\right)^y}$$

Tangents :

$e_{n.i.a}(f) := e_{n.wn}$ $e_{n.i.b}(f) := e_{n.wn} \cdot \sqrt{\left(\frac{f}{f_{c.e1}}\right)^x}$ $e_{n.i.c}(f) := e_{n.wn} \cdot \sqrt{\left(\frac{f}{f_{c.e3}}\right)^y}$



$e_{n.i}(1Hz) = 63.5 \times 10^{-9} V$

$e_{n.i}(10Hz) = 8.8 \times 10^{-9} V$

$e_{n.i}(30Hz) = 5.5 \times 10^{-9} V$

$e_{n.i}(100Hz) = 4.1 \times 10^{-9} V$

$e_{n.i}(1kHz) = 3.5 \times 10^{-9} V$

$e_{n.i}(10kHz) = 3.4 \times 10^{-9} V$

$e_{n.i}(100kHz) = 3.4 \times 10^{-9} V$

Fig. 1.1 = Fig. 9

2. Slopes :

$$SL_{e1} := 20\cdot\log\left(\frac{e_{n.i.b}(10Hz)}{e_{n.i.b}(1Hz)}\right) \qquad SL_{e1} = -10.000 \qquad [dB]$$

$$SL_{e2} := 20\cdot\log\left(\frac{e_{n.i.c}(10Hz)}{e_{n.i.c}(1Hz)}\right) \qquad SL_{e2} = -25.000 \qquad [dB]$$

3. RMS voltage noise in three bandwidths, deltas D, plus average densities avg :

$$e_{N.i.1k} := \sqrt{\frac{1}{B_1}\cdot\int_{1Hz}^{1kHz}\left(\left|e_{n.i}(f)\right|\right)^2 df} \qquad e_{N.i.1k} = 132.885\times 10^{-9}V$$

$$e_{N.i.s.1k} := 132.885\cdot 10^{-9}V$$

$$D_{e.1k} := 20\cdot\log\left(\frac{e_{N.i.1k}}{e_{N.i.s.1k}}\right) \qquad D_{e.1k} = 0.000 \qquad [dB]$$

$$e_{n.i.1k.avg} := e_{N.i.1k}\cdot\sqrt{\frac{B_1}{B_{1k}}} \qquad e_{n.i.1k.avg} = 4.204\times 10^{-9}V$$

$$e_{N.i.20k} := \sqrt{\frac{1}{B_1}\cdot\int_{20Hz}^{20kHz}\left(\left|e_{n.i}(f)\right|\right)^2 df} \qquad e_{N.i.20k} = 484.549\times 10^{-9}V$$

$$e_{N.i.s.20k} := 484.549\cdot 10^{-9}V$$

$$D_{e.20k} := 20\cdot\log\left(\frac{e_{N.i.20k}}{e_{N.i.s.20k}}\right) \qquad D_{e.20k} = 0.000 \qquad [dB]$$

$$e_{n.i.20k.avg} := e_{N.i.20k}\cdot\sqrt{\frac{B_1}{B_{20k}}} \qquad e_{n.i.20k.avg} = 3.428\times 10^{-9}V$$

$$e_{N.i.100k} := \sqrt{\frac{1}{B_1}\cdot\int_{1Hz}^{100kHz}\left(\left|e_{n.i}(f)\right|\right)^2 df} \qquad e_{N.i.100k} = 1.079\times 10^{-6}V$$

$$e_{N.i.s.100k} := 1.07918\cdot 10^{-6}V$$

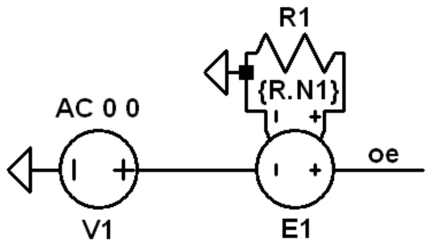
$$D_{e.100k} := 20\cdot\log\left(\frac{e_{N.i.100k}}{e_{N.i.s.100k}}\right) \qquad D_{e.100k} = -0.000 \qquad [dB]$$

$$e_{n.i.100k.avg} := e_{N.i.100k}\cdot\sqrt{\frac{B_1}{B_{100k}}} \qquad e_{n.i.100k.avg} = 3.413\times 10^{-9}V$$

4. Simulation approach :

Note : $e_{n.i}(f) = V(oe)$

```
.noise V(oe) V1 oct 100 1 100k
.param e.n=3.4e-09 f.ce1=47.5 f.ce3=9.8
.param T=300.15 k=1.38065e-23
.param R.N1=pow(e.n,2)/(4*k*T)
```

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Laplace=sqrt(1+pow(abs(s)/(2*pi*f.ce1),-1)+pow(abs(s)/(2*pi*f.ce3),-2.5))
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Fig. 1.2 = Fig. 11

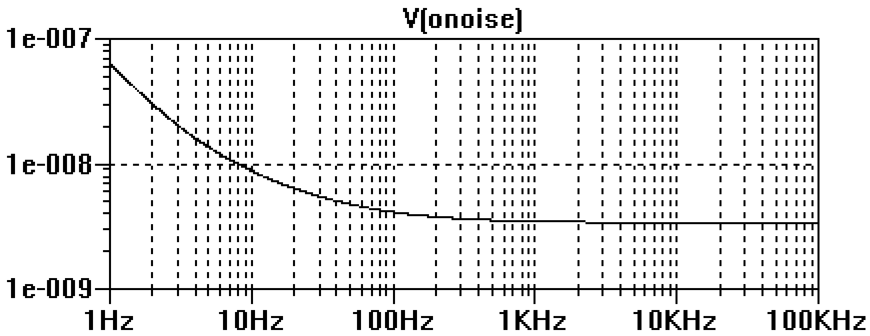

Fig. 1.3 = Fig. 10