

# ELEKTRONSKE KOMPONENTE

UNI

1. kolokvij 08.12.2010

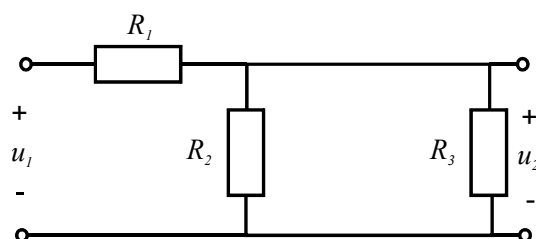
1. V tabeli so podani statistični podatki o številu odpovedi temperaturnih senzorjev v obdobju 12 let od proizvodnje. Izračunajte MTTF.

Leto	1	2	3	4	5	6	7	8	9	10	11	12
Št. odpovedi	118	0	10	5	7	9	36	124	314	481	411	48

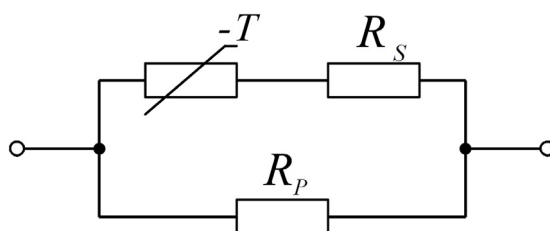
2. Za dani četverpol izračunajte šumno napetost na izhodnih sponkah, če so na vhodu **odprte sponke**. Zanima nas šum v frekvenčnem področju od 0 do 100 kHz. Vezje ima temperaturo 27°C.

$$B=100 \text{ kHz} \quad R_1=R_2=R_3=100 \text{ k}\Omega$$

$$T=300 \text{ K} \quad k=1,38 \cdot 10^{-23} \text{ J/K}$$



3. Določite paralelno upornost  $R_P$  in serijsko upornost  $R_S$  v danem termistorskem vezju tako, da bo upornost tega dvopola pri temperaturi  $T = 20^\circ\text{C}$  znašala  $100 \Omega$ , pri  $T = 80^\circ\text{C}$  pa  $50 \Omega$ . Termistor v vezju ima hladno upornost  $R_{20} = 150 \Omega$  in materialno konstanto  $B = 2500 \text{ K}$ .

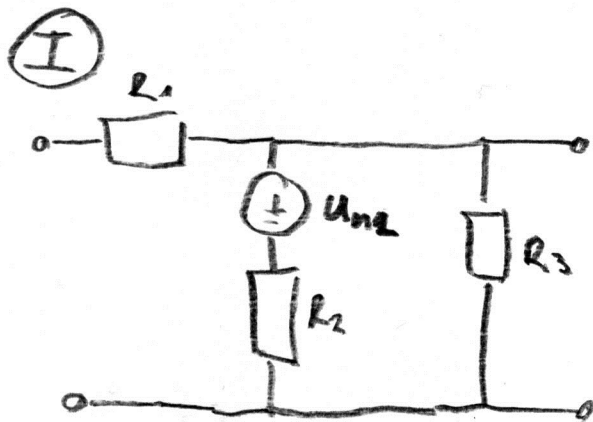


4. Kolikšna sta tok in diferencialna prevodnost varistorja pri napetosti 50 V? Podatki varistorja so:  $U_N=40 \text{ V}$ ,  $I_N=1 \text{ mA}$  in  $\alpha=18$ .

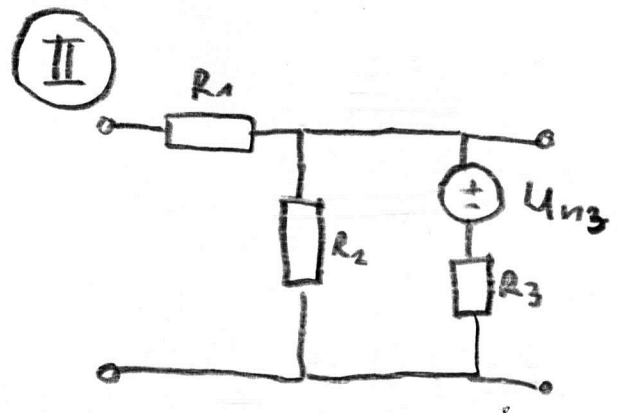
1. MTTF:  $\sum_{i=0}^{\infty} t_i f(t_i) = 1 \cdot \frac{118}{1563} + 3 \cdot \frac{10}{1563} + 4 \cdot \frac{5}{1563} + 5 \cdot \frac{7}{1563} +$   
 $6 \cdot \frac{9}{1563} + 7 \cdot \frac{36}{1563} + 8 \cdot \frac{124}{1563} + 9 \cdot \frac{314}{1563} + 10 \cdot \frac{481}{1563} + 11 \cdot \frac{411}{1563} + 12 \cdot \frac{48}{1563} =$   
9,1 LETA

2. NA VHODU NI  
PRIKLJUČENO NIČ!!!

NA IZHODU NI PRISPEVKA ŠUMA ZARADI UPORA  $R_1$ ,  
ZATO GA IZPUSTIMO IZ OBRAVNAVE!



$$U_{12} = U_{n2} \frac{R_3}{R_2 + R_3}$$



$$U_{23} = U_{n3} \frac{R_2}{R_2 + R_3}$$

$$U_2 = U_{12} + U_{23}$$

$$U_N = \sqrt{U_{NR2}^2 \left( \frac{R_3}{R_2 + R_3} \right)^2 + U_{NR3}^2 \left( \frac{R_2}{R_2 + R_3} \right)^2}$$

$$U_{NR2} = U_{NR3} = U_{NR} = \sqrt{4kTRB} = \sqrt{4 \cdot 1,38 \cdot 10^{-23} \text{ J/K} \cdot 300 \text{ K} \cdot 100 \cdot 10^3 \Omega \cdot 100 \cdot 10^3 \text{ Hz}} =$$
  
 $= 12,9 \mu\text{V}$

$$U_N = U_{NR} \sqrt{\left( \frac{R_3}{R_2 + R_3} \right)^2 + \left( \frac{R_2}{R_2 + R_3} \right)^2} = \underline{\underline{9,12 \mu\text{V}}}$$

$$3. R_T(T) = R_{T0} \cdot e^{B \left( \frac{1}{T} - \frac{1}{T_0} \right)}$$

$$R_{T80} = 150 \Omega \cdot e^{2500k \left( \frac{1}{353k} - \frac{1}{293k} \right)} = 35,2 \Omega$$

$$\frac{1}{R(80)} = \frac{1}{R_p} + \frac{1}{R_{T80} + R_s}$$

$$\frac{1}{R(20)} = \frac{1}{R_p} + \frac{1}{R_{T20} + R_s}$$

$$\frac{1}{R(80)} - \frac{1}{R(20)} = \Delta G = \frac{1}{R_{T80} + R_s} - \frac{1}{R_{T20} + R_s}$$

$$R_s^2 + (R_{T80} + R_{T20}) R_s + R_{T20} R_{T80} + \frac{R_{T80} - R_{T20}}{\Delta G} = 0$$

$$R_s^2 + 185,2 \Omega R_s - 6200 \Omega^2 = 0$$

$$R_s = \underline{\underline{29 \Omega}}$$

$$R_p = \underline{\underline{226,6 \Omega}}$$

$$4. \frac{1}{I_N} = \left( \frac{U}{U_N} \right)^\alpha \Rightarrow I = I_N \left( \frac{U}{U_N} \right)^\alpha; \quad I(50V) = 1 \mu A \left( \frac{50}{40} \right)^{12} = \underline{\underline{55,5 \mu A}}$$

$$g = \frac{dI}{dU}; \quad I = k U^\alpha$$

$$g = k \alpha U^{\alpha-1} = \alpha \frac{I}{U} = \underline{\underline{0,02 S}}$$