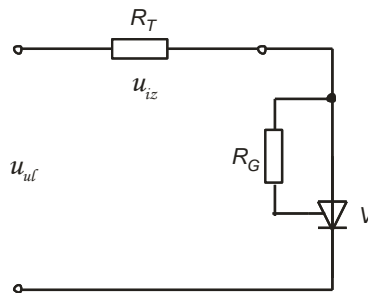


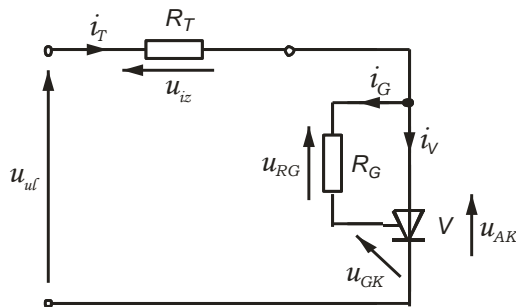
12. domaća zadaća iz Elektroničkih komponenta

1. Na ulaz spoja sa slike dovodi se sinusoidan napon maksimalne vrijednosti $U_m = 400$ V. Struja potrebna za otvaranje tiristora je $I_G = 200$ mA. Vrijednosti otpora su $R_G = 1$ k Ω , $R_T = 20$ Ω . Izračunajte snagu P na otporu trošila R_T .



Rješenje

1.



$$i_T = i_G + i_V$$

$$u_{ul} = u_{iz} + u_{RG} + u_{GK}$$

$$u_{ul} = u_{iz} + u_{AK}$$

$$u_{iz} = R_T \cdot i_T, \quad u_{RG} = R_G \cdot i_G$$

$$\boxed{u_{ul} < 0} \rightarrow u_{AK} < 0, u_{GK} < 0 \rightarrow \text{tiristor ne vodi } i_G = 0, i_V = 0, i_T = 0 \Rightarrow \boxed{u_{iz} = 0}$$

$$\boxed{u_{ul} > 0} \quad \text{Hoće li tiristor voditi struju ovisi o struji geita } i_G.$$

$$\underline{0 \leq \omega t < \theta}$$

$i_G < I_G$... Tiristor još ne vodi, jer nije dobio dovoljnu struju geita.

$$i_V = 0 \rightarrow i_T = i_G \quad \dots \quad u_{ul} = (R_T + R_G) \cdot i_G$$

$$i_T \ll I_G \rightarrow \boxed{u_{iz} \approx 0}$$

$\omega t = \theta$ Ovo je trenutak, odnosno kut pri kojem će tiristor provesti.

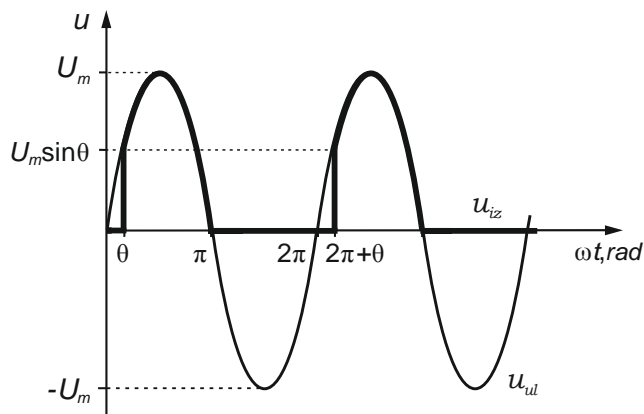
$$i_G = I_G \quad \dots \quad u_{ul} = U_m \sin \omega t = (R_T + R_G) \cdot I_G \quad \dots \quad \omega t = \theta = \arcsin \frac{(R_T + R_G) \cdot I_G}{U_m}$$

$$\theta = \arcsin \frac{204}{400} = 30,66^\circ = 0,5352 \text{ rad}$$

Kada sinusna funkcija dosegne napon od $u_{ul} = (R_T + R_G) \cdot I_G = 204 \text{ V}$ odnosno kut od $30,66^\circ$ tiristor provede.

Tiristor ostaje u stanju vođenja dokle god je ulazni napon pozitivan.

$$\underline{\theta \leq \omega t < \pi} \quad u_{AK} \approx 0 \quad \rightarrow \quad \boxed{u_{iz} = u_{ul}}$$



$$P = \frac{U_{iz}^2}{R_T}$$

$$U_{iz} = \sqrt{\frac{1}{T} \int_0^T u_{iz}^2 dt}$$

$$U_{iz} = \sqrt{\frac{1}{2\pi} \int_{\theta}^{\pi} (U_m \sin \omega t)^2 d\omega t} = \sqrt{\frac{U_m^2}{2\pi} \int_{\theta}^{\pi} \frac{1 - \cos 2\omega t}{2} d\omega t} = \sqrt{\frac{U_m^2}{4\pi} \cdot \left(\omega t - \frac{\sin 2\omega t}{2} \right) \Big|_{\theta}^{\pi}} =$$

$$U_{iz} = \frac{U_m}{2} \sqrt{\frac{\pi - \theta}{\pi} + \frac{\sin 2\theta}{2\pi}}$$

$$U_{iz} = 196,9 \text{ V} .$$

$$P = 1,939 \text{ kW} .$$