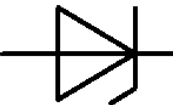
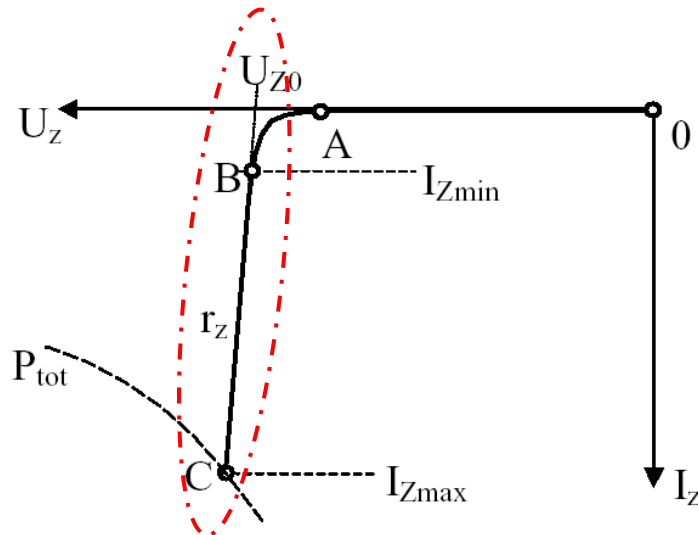


Zener dioda

➤ simbol: anoda  katoda

➤ statična U-I karakteristika

➤ plazovit reverzibilen (ponovljiv) plazoviti preboj v reverzni smeri



➤ uporaba: referenčni napetostni vir, ...

Zener dioda

➤ razpon napetosti, moči

Oznaka družine	BZX55	BZX85	BZV48	ZX
oznaka	BZX 55 C2V7 ...BZX55 C110	BZX85 C2V7 ...BZX85 C110	BZV48 C3V3 ...BZV48 C200	ZX 3,9 ... ZX 200
Zener napetost	2,7 ... 110 V	2,7 ... 110 V	3,3 ... 200 V	3,9 ... 200 V
Izgubna moč	0,5 W	1,3 W	5 W	10 W (hladilno telo)
Ohišje	Stekleno z aksialnimi priključki	Stekleno z aksialnimi priključki	Plastično z aksialnimi priključki	Kovinsko ohišje z vijačno pritrditvijo

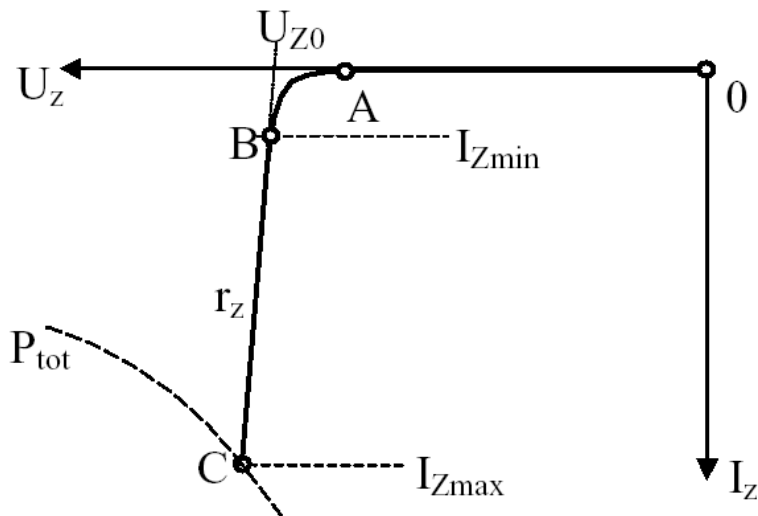
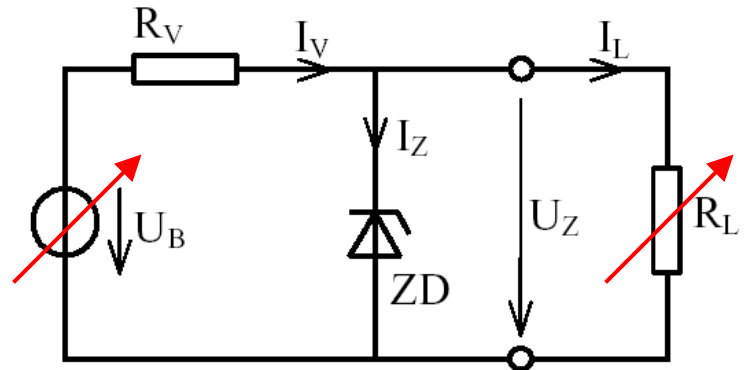
Zener dioda

BZX79- Bxxx Cxxx	WORKING VOLTAGE V_Z (V) at $I_{Ztest} = 5$ mA				DIFFERENTIAL RESISTANCE r_{dif} (Ω)				TEMP. COEFF. S_Z (mV/K) at $I_{Ztest} = 5$ mA (see Figs 5 and 6)			DIODE CAP. C_d (pF) at $f = 1$ MHz; $V_R = 0$ V	NON-REPETITIVE PEAK REVERSE CURRENT I_{ZSM} (A) at $t_p = 100$ μ s; $T_{amb} = 25$ $^{\circ}$ C
	Tol. $\pm 2\%$ (B)		Tol. approx. $\pm 5\%$ (C)		at $I_{Ztest} = 1$ mA		at $I_{Ztest} = 5$ mA		MIN.	TYP.	MAX.	MAX.	MAX.
	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.					
2V4	2.35	2.45	2.2	2.6	275	600	70	100	-3.5	-1.6	0	450	6.0
2V7	2.65	2.75	2.5	2.9	300	600	75	100	-3.5	-2.0	0	450	6.0
3V0	2.94	3.06	2.8	3.2	325	600	80	95	-3.5	-2.1	0	450	6.0
3V3	3.23	3.37	3.1	3.5	350	600	85	95	-3.5	-2.4	0	450	6.0
3V6	3.53	3.67	3.4	3.8	375	600	85	90	-3.5	-2.4	0	450	6.0
3V9	3.82	3.98	3.7	4.1	400	600	85	90	-3.5	-2.5	0	450	6.0
4V3	4.21	4.39	4.0	4.6	410	600	80	90	-3.5	-2.5	0	450	6.0
4V7	4.61	4.79	4.4	5.0	425	500	50	80	-3.5	-1.4	0.2	300	6.0
5V1	5.00	5.20	4.8	5.4	400	480	40	60	-2.7	-0.8	1.2	300	6.0
5V6	5.49	5.71	5.2	6.0	80	400	15	40	-2.0	1.2	2.5	300	6.0
6V2	6.08	6.32	5.8	6.6	40	150	6	10	0.4	2.3	3.7	200	6.0
6V8	6.66	6.94	6.4	7.2	30	80	6	15	1.2	3.0	4.5	200	6.0
7V5	7.35	7.65	7.0	7.9	30	80	6	15	2.5	4.0	5.3	150	4.0
8V2	8.04	8.36	7.7	8.7	40	80	6	15	3.2	4.6	6.2	150	4.0
9V1	8.92	9.28	8.5	9.6	40	100	6	15	3.8	5.5	7.0	150	3.0
10	9.80	10.20	9.4	10.6	50	150	8	20	4.5	6.4	8.0	90	3.0
11	10.80	11.20	10.4	11.6	50	150	10	20	5.4	7.4	9.0	85	2.5
12	11.80	12.20	11.4	12.7	50	150	10	25	6.0	8.4	10.0	85	2.5
13	12.70	13.30	12.4	14.1	50	170	10	30	7.0	9.4	11.0	80	2.5
15	14.70	15.30	13.8	15.6	50	200	10	30	9.2	11.4	13.0	75	2.0
16	15.70	16.30	15.3	17.1	50	200	10	40	10.4	12.4	14.0	75	1.5
18	17.60	18.40	16.8	19.1	50	225	10	45	12.4	14.4	16.0	70	1.5
20	19.60	20.40	18.8	21.2	60	225	15	55	12.3	15.6	18.0	60	1.5
22	21.60	22.40	20.8	23.3	60	250	20	55	14.1	17.6	20.0	60	1.25
24	23.50	24.50	22.8	25.6	60	250	25	70	15.9	19.6	22.0	55	1.25

Stabilizacijsko vezje z Zener diodo

➤ cilj: konstantna izh. napetost ne glede na:

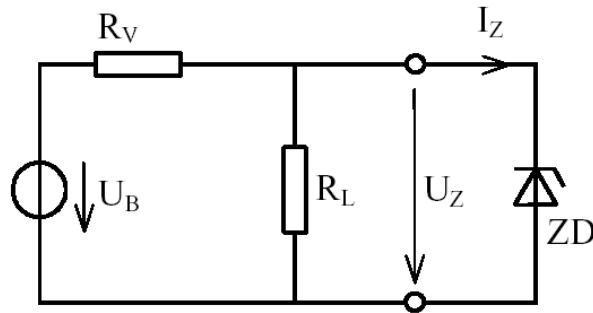
- spremembo vh. napetosti,
- spremembo bremenskega toka



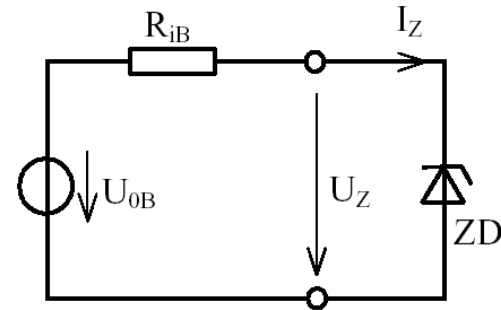
➤ zahteve:

- majhna r_Z ,
- razpon toka: od I_{Zmin} do I_{Zmax}

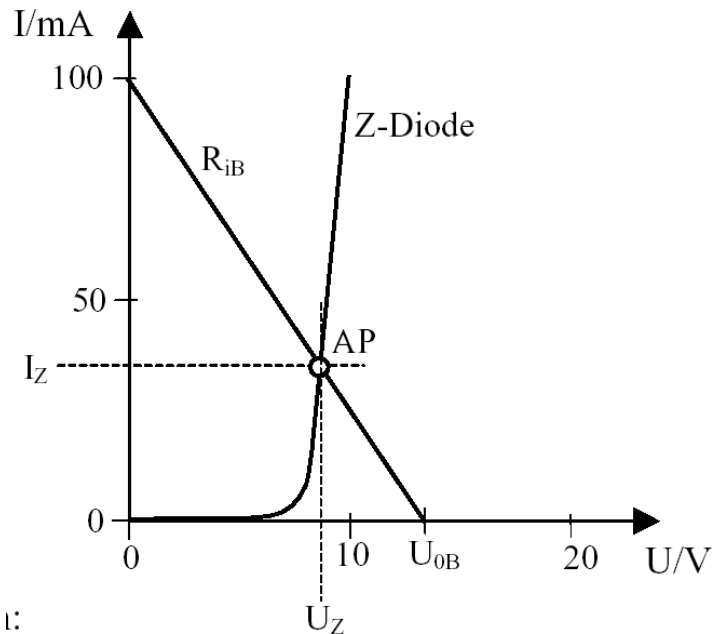
Stabilizacijsko vezje-analiza 1



Thevenin
 \Rightarrow



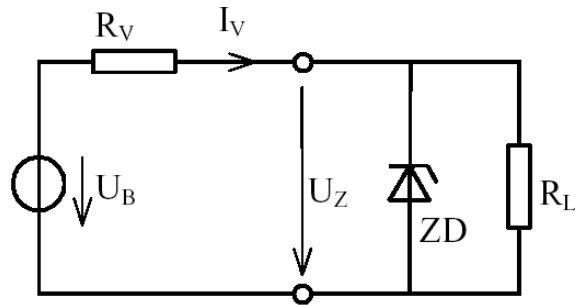
$$R_{iB} = \frac{R_V \cdot R_L}{R_V + R_L} = 133,3 \Omega$$



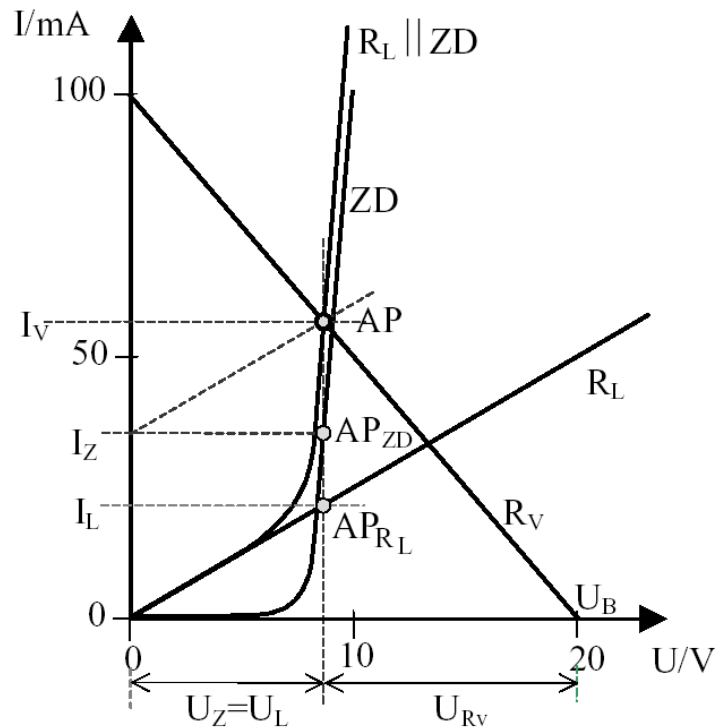
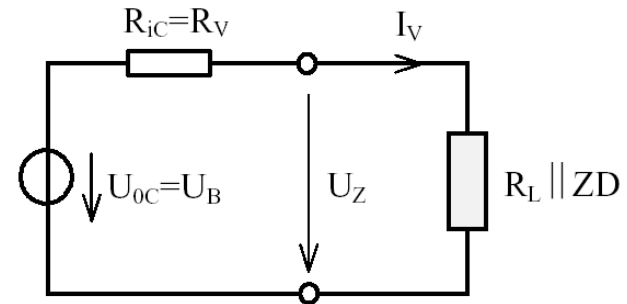
$$U_{0B} = U_B \cdot \frac{R_L}{R_V + R_L} = 13,3 \text{ V}$$

$$I_Z \approx 35 \text{ mA} \quad U_Z \approx 8,7 \text{ V}$$

Stabilizacijsko vezje-analiza 2



Thevenin
 \Rightarrow



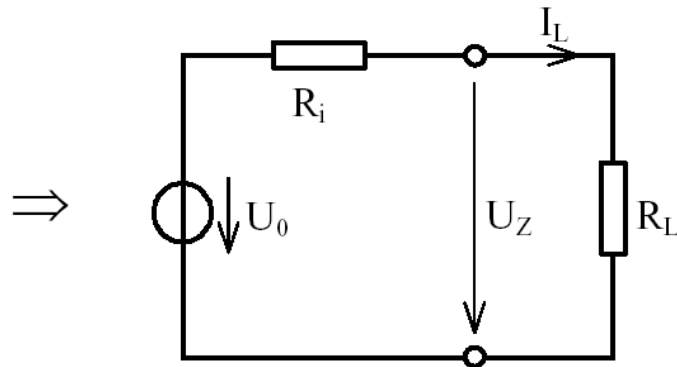
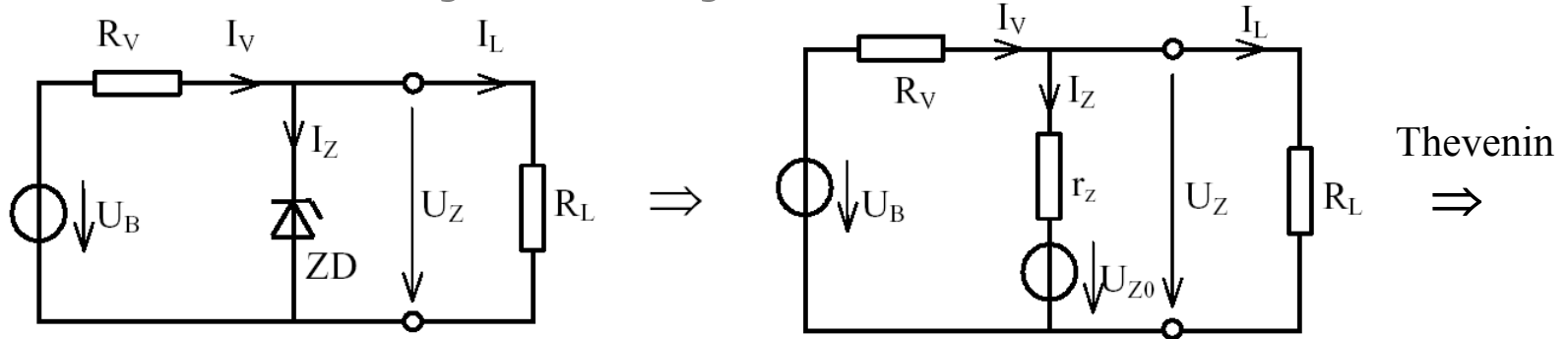
$$I_V \approx 56,7 \text{ mA} \quad U_Z = U_L \approx 8,7 \text{ V}$$

$$I_Z \approx 35 \text{ mA}$$

$$I_L \approx 21,5 \text{ mA}$$

$$U_{R_V} = U_B - U_Z \approx 11,3 \text{ V}$$

Stabilizacijsko vezje-analiza 3-analitično



$$U_0 = U_B \frac{r_Z}{R_V + r_Z} + U_{Z0} \frac{R_V}{R_V + r_Z} = 9,09 \text{ V}$$

$$R_i = \frac{R_V \cdot r_Z}{R_V + r_Z} = 18,18 \Omega$$

$$U_L = U_Z = U_0 \frac{R_L}{R_L + R_i} = 8,7 \text{ V}$$

$$I_L = \frac{U_0}{R_L + R_i} = 21,74 \text{ mA}$$

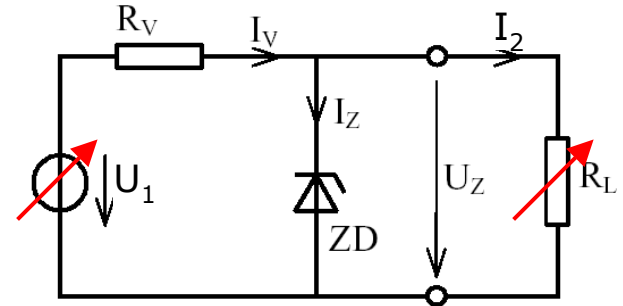
Stabilizacijsko vezje-analiza občutljivosti ...

Stabilizacijsko vezje-izračun predupora

➤ najneugodnejša primera nastopita pri:

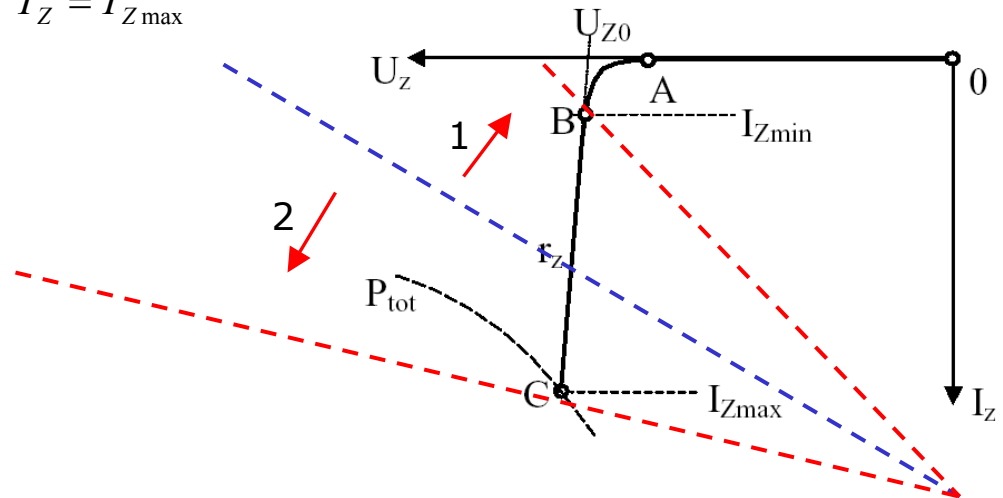
$$U_1 = U_{1\min} \quad U_2 = U_Z \quad I_2 = I_{2\max} \quad \Rightarrow \quad I_Z = I_{Z\min}$$

$$R_{\min} = \frac{U_{1\min} - U_Z}{I_{2\max} + I_{Z\min}} = \text{_____} \Omega$$

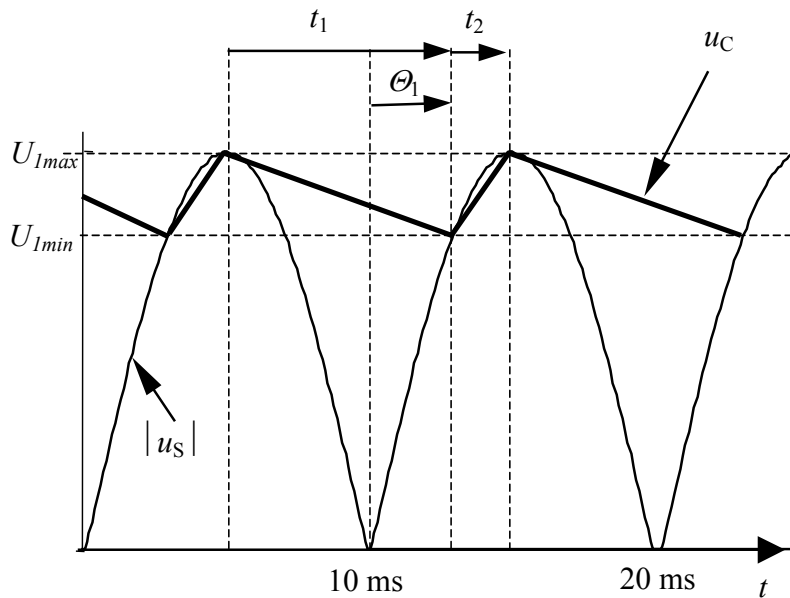
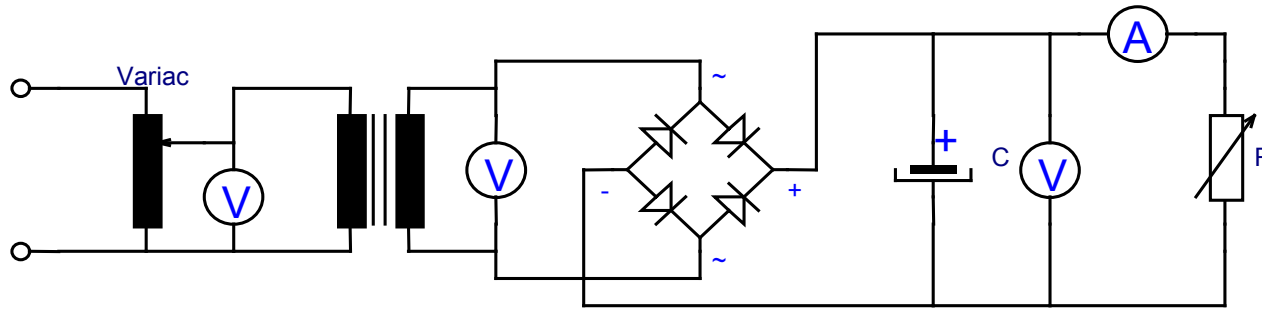


$$U_1 = U_{1\max} \quad U_2 = U_Z \quad I_2 = I_{2\min} \quad \Rightarrow \quad I_Z = I_{Z\max}$$

$$R_{\max} = \frac{U_{1\max} - U_Z}{I_{2\min} + I_{Z\max}} = \text{_____} \Omega$$



Stabilizacijsko vezje-navezava na lab.vajo



$$\sin \Theta_1 = \frac{U_{1\min}}{U_{1\max}} = \underline{\hspace{2cm}} \quad \Theta_1 = \arcsin \frac{U_{1\min}}{U_{1\max}} = \underline{\hspace{2cm}}$$

$$t_1 = 5 \text{ ms} + \Theta_1 \cdot \frac{10 \text{ ms}}{180^\circ} = \underline{\hspace{2cm}} \text{ s}$$

$$t_2 = 5 \text{ ms} - \Theta_1 \cdot \frac{10 \text{ ms}}{180^\circ} = \underline{\hspace{2cm}} \text{ s}$$

$$C(I_b = 100 \text{ mA}) = \frac{I_b \cdot t_1}{\Delta U_1} = \underline{\hspace{2cm}} \mu\text{F}$$