Elektronik Devreler I

Doç. Dr. Revna ACAR VURAL

1.Ödev

Alirıza BİLİR

No:18014125

17 NİSAN 2022

YILDIZ TEKNİK ÜNİVERSİTESİ 1911

S1)

A)Simülasyon Kodu

ED1-1.cir (active) | ED1-1.dat (active)

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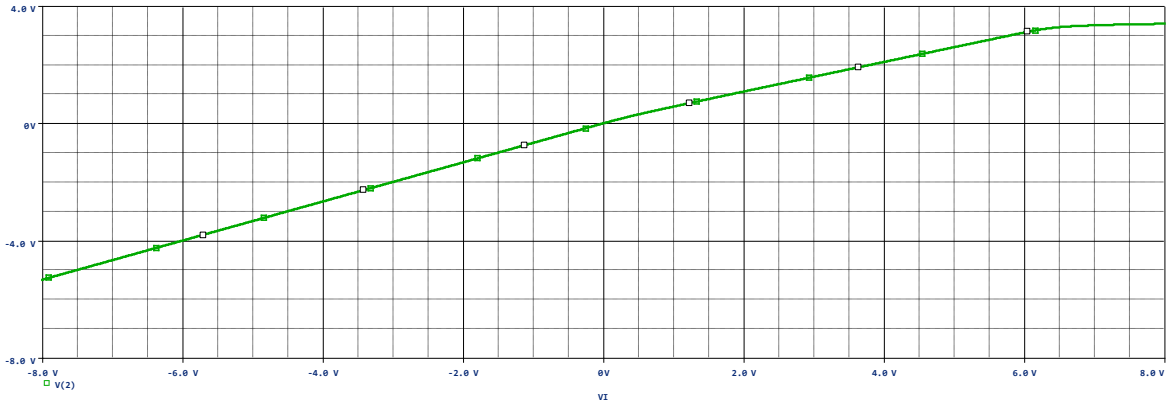
*Alinza Bilir
VI 1 0 DC 0
VE 4 0 DC 3V

R1 1 2 20k
R2 2 0 40k
R3 3 0 40k

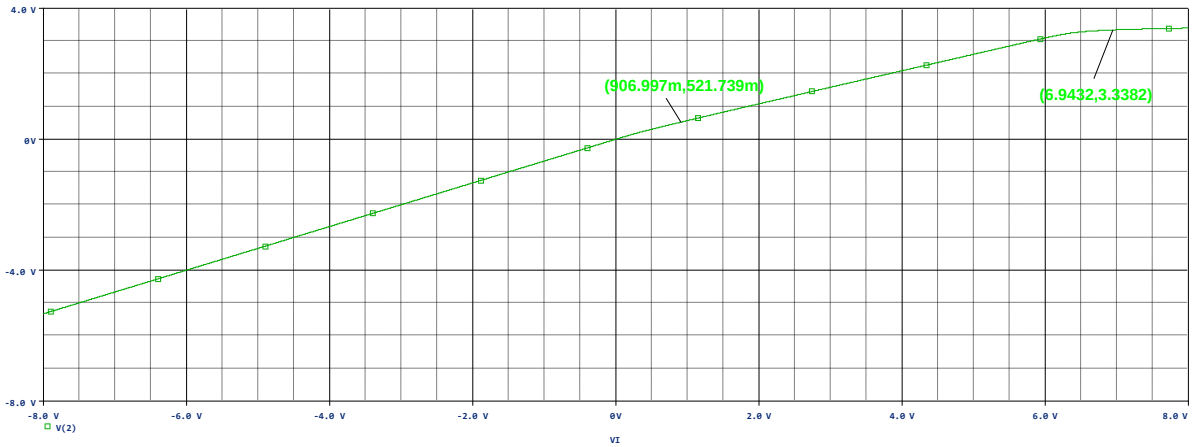
D1 2 3 D1N4001
D2 2 4 D1N4001

.model D1N4001 D (IS=29.5E-9 RS=73.5E-3 N=1.96 CJO=34.6P VJ=0.627 M=0.461 BV=60 IBV=10U)
.DC VI -8 8 0.001
.probe
.END
```

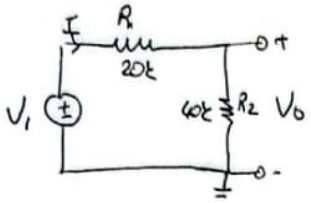
$V_O = f(V_I)$ gerilim transfer karakteristiği simülasyon sonucu:



B)



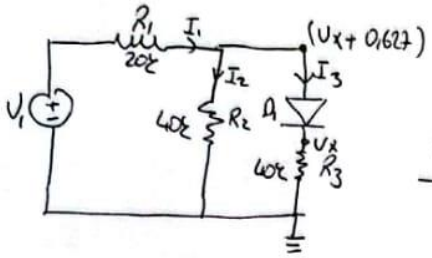
$V_0 < 0.627$ iken D_1: Off D_2: Off



$V_0 = I \cdot R_2 = I \cdot 40k$

$I = \frac{V_1}{R_1+R_2} = \frac{V_1}{60k}$ $\Big\}$ $V_0 = \frac{2}{3} V_1$ (1)

$3.627 > V_0 \geq 0.627$ iken D_1: ON D_2: Off



$I_1 = I_2 + I_3$

$\frac{V_1 - 0,627 - V_x}{R_1} = \frac{V_x + 0,627}{R_2} + \frac{V_x}{R_3 + R_{D1}}$

$\Rightarrow \frac{V_1 - 0,627 - V_x}{20k} = \frac{V_x + 0,627}{40k} + \frac{V_x}{40k + 735 \times 10^{-3}}$

$\Rightarrow V_1 = 2V_x + 0,9405 \Rightarrow V_x = \frac{V_1 - 0,9405}{2} = \frac{V_1}{2} - 0,47025$

$V_0 = V_x + 0,627 = \frac{V_1}{2} + 0,15675$ (2)

$V_0 = 0,627$ için:

(2) $0,627 = \frac{V_1}{2} + 0,15675$

$V_1 = 0,9405$

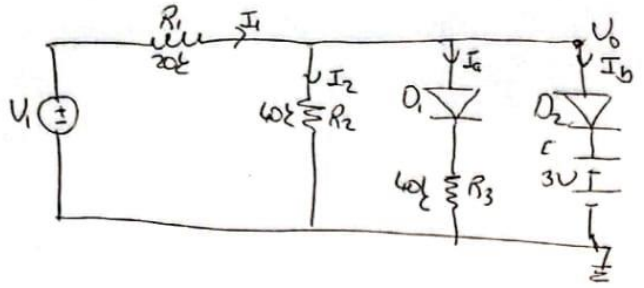
(1) $0,627 = \frac{2}{3} V_1$

$V_1 = 0,9405$

$V_1 = -8$ için:

(1) $V_0 = \frac{2}{3}(-8) \cong -5,33$

$V_o \geq 3,627$ iken D_1: ON D_2: ON



$I_1 = I_2 + I_a + I_b$

$$\frac{V_1 - V_o}{R_1} = \frac{V_o}{R_2} + \frac{V_o - 0.627}{R_3 + R_{s1}} + \frac{V_o - 3,627}{R_{s2}}$$

$$\Rightarrow \frac{V_1 - V_o}{20k} = \frac{V_o}{40k} + \frac{V_o - 0,627}{40k + 73,5\times10^{-3}} + \frac{V_o - 3,627}{73,5 \times 10^{-3}} \quad (3)$$

$V_o = 3,627$ için

(3) $V_1 = 6,9405$

(2) $3,627 = \frac{V_1}{2} + 0,15675$

$V_1 = 6,9405$

$V_1 = 8$ için

(3) $V_o = 3,627$

$-8 < V_1 < 0,9405$

D_1 : Off
D_2 : Off

$V_1 = -8 \Rightarrow V_0 = -5,33$
$V_1 = 0,9405 \Rightarrow V_0 = 0,627$

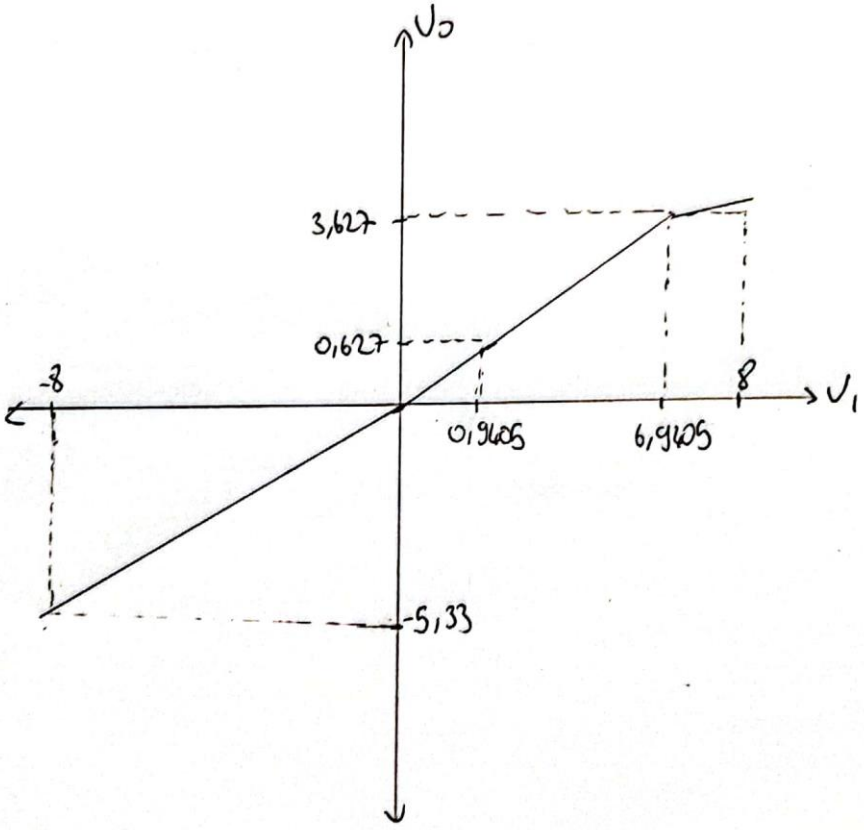
$0,9405 \leq V_1 < 6,9405$

D_1 : ON
D_2 : Off

$V_1 = 6,9405 \Rightarrow V_0 = 3,627$
$V_1 = 8 \Rightarrow V_0 = 3,627$

$6,9405 \leq V_1 < 8$

D_1 : ON
D_2 : ON



C)

IS	Saturation current (tıkama akımı)
RS	Series resistance
N	Emission coefficient
TT	Transit time
CJO	Zero-bias junction capacitance (tdD'deki jonksiyon kapasitesi)
VJ	Junction potential
M	Junction grading coefficient
EG	Activation energy:
XTI	IS temperature exponent
KF	Flicker noise coefficient
AF	Flicker noise exponent
FC	Forward bias depletion capacitance coefficient
BV	Reverse breakdown voltage
IBV	Reverse breakdown current

52)

$V_1 = \frac{25}{25} + 1 = 2$ $\qquad$ $V_2 = 8,5 - \frac{25}{25} = 7,5$

$-V_2 < V_I < V_1$ aralığında, $V_I = V_O$ *

$V_I \geq V_1 = 2$ için:

$V_O - 6 = \left(\frac{6 - V_1}{10 - V_1}\right)(V_I - 10)$

$V_O - 6 = \left(\frac{6-2}{10-2}\right)(V_I - 10)$

$\downarrow$

$0,5$

$V_I \geq V_1 = 2$, $V_O = 0,5 V_I + 1$ *

$V_I \leq -V_2 = -7,5$ için;

$V_O + 9 = \left(\frac{-9 + V_2}{-10 + V_2}\right)(V_I + 10)$

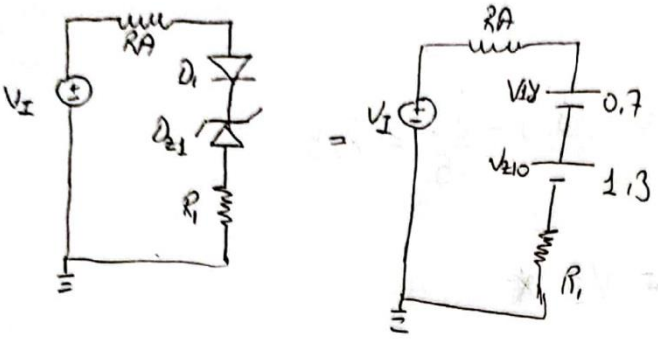
$V_O + 9 = \left(\frac{-9 + 7,5}{-10 + 7,5}\right)(V_I + 10)$

$\downarrow$

$0,6$

$V_I \leq V_2$, $V_O = 0,6 V_I - 3$ *

$V_I \geq V_1 = 2$ için

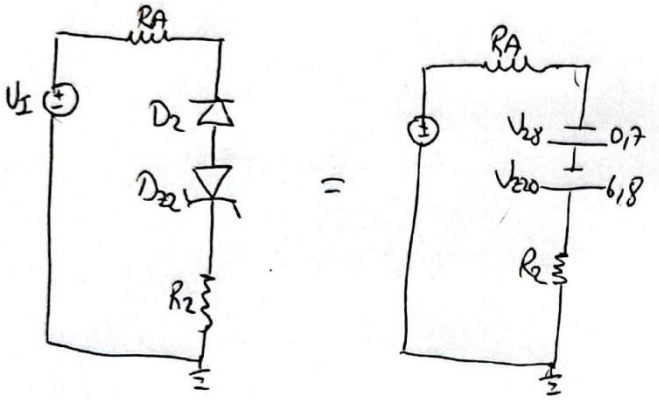


$\frac{10}{R_A+R_1} < 5mA$

$R_A + R_1 > 2k$

$\frac{R_1}{R_A+R_1} = 0,5$ (eşitsizlik)

$V_I \leq V_2 = -7,5$ için

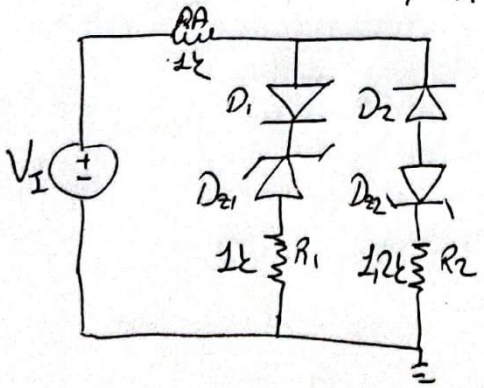


$\frac{10}{R_A+R_2} < 5mA$

$R_A + R_2 > 2k$

$\frac{R_2}{A_A+R_1} = 0,6$ (eşitsizlik)

$R_A = 1k$, $R_2 = 1,2k$, $R_1 = 1k$



D_1 ($V_\gamma = 0,7$ $r_d = 0$)

D_2 ($V_\gamma = 0,7$ $r_d = 0$)

D_{z1} ($V_{z0} = 1,3$ $r_z = 0$)

D_{z2} ($V_{z0} = 6,8$ $r_z = 0$)