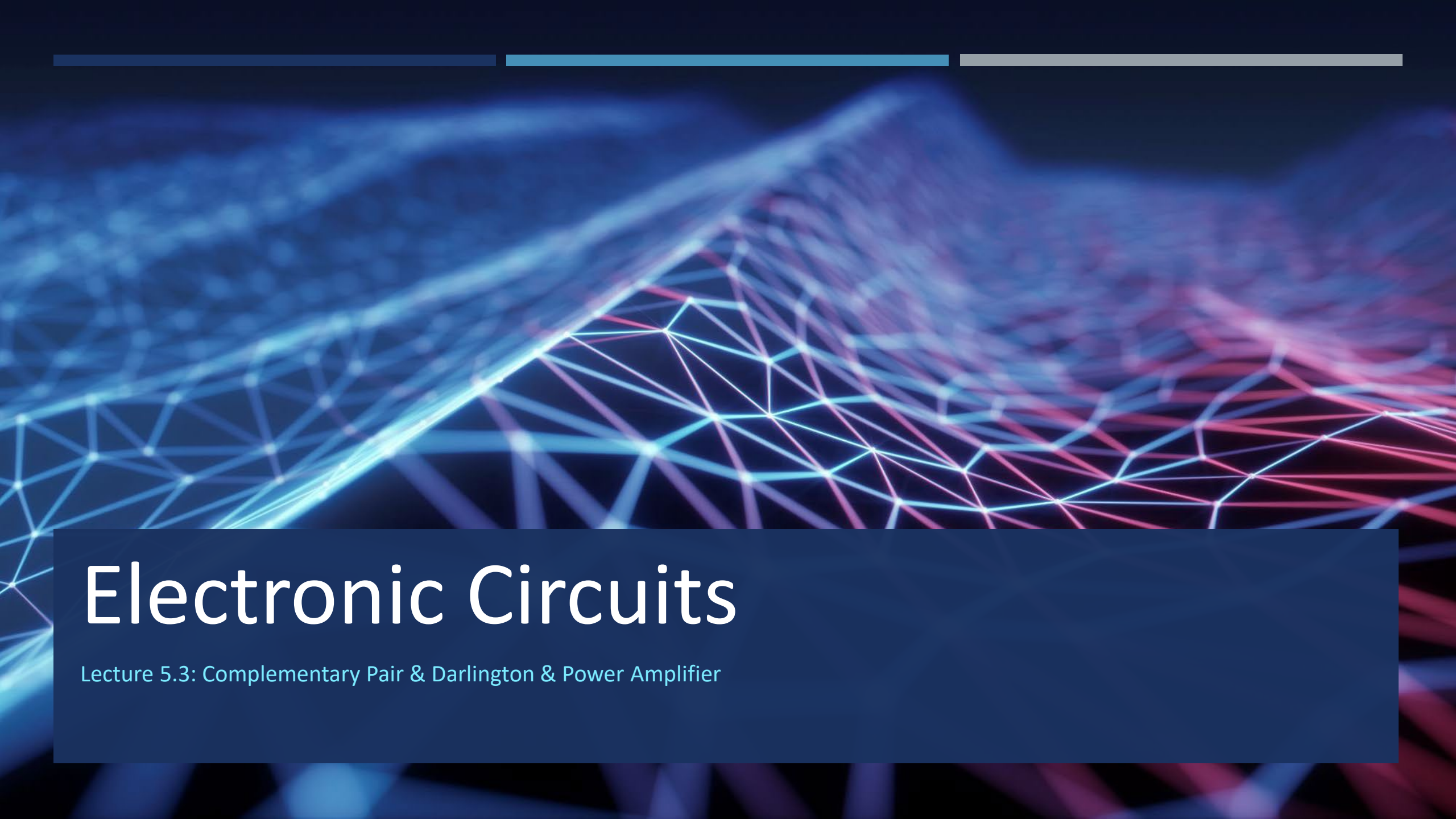
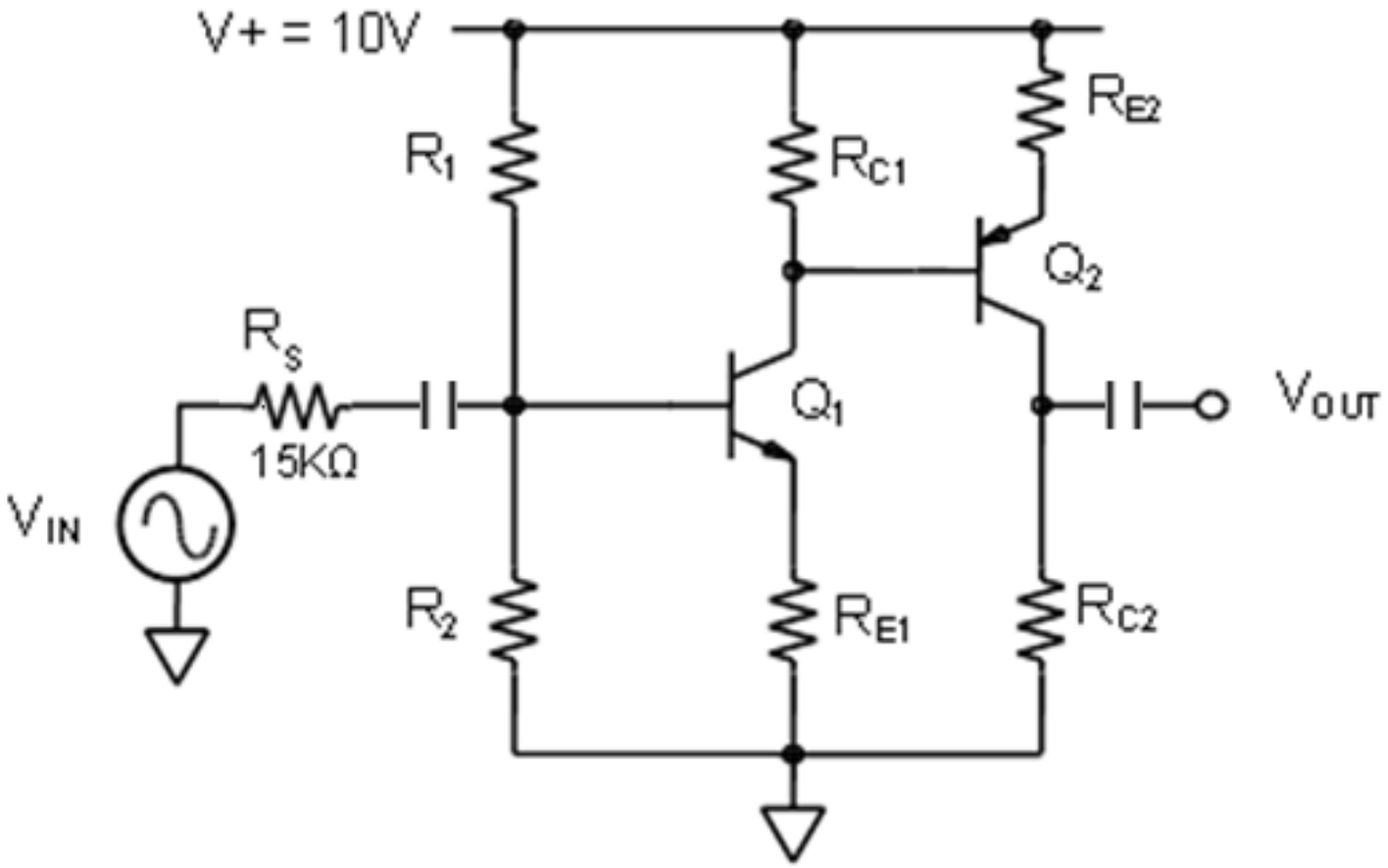


Electronic Circuits

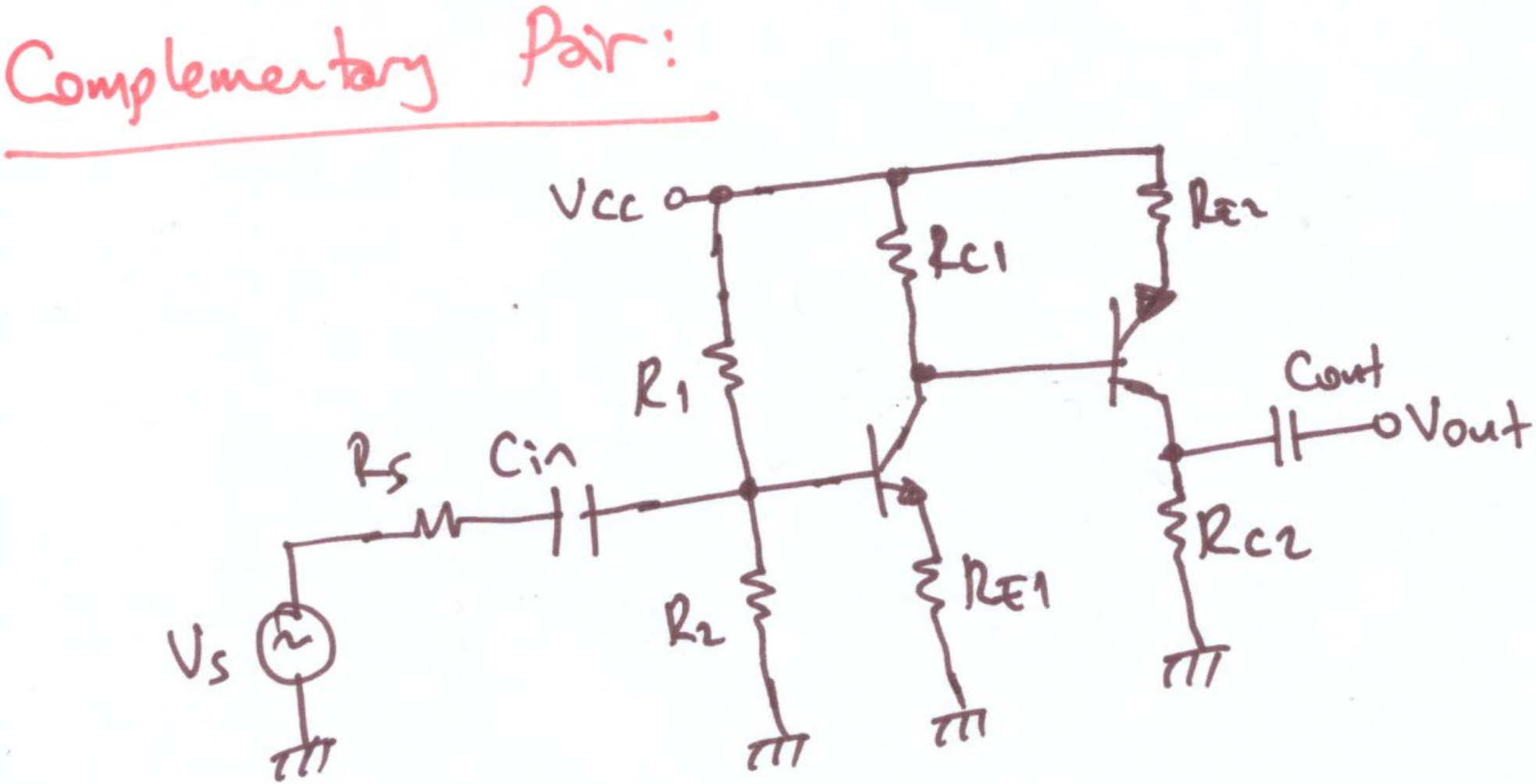
Lecture 5.3: Complementary Pair & Darlington & Power Amplifier

Complementary Pair Connection



- Design a Complementary Pair amplifier stage using 2N3904 and 2N3906 transistor's (β ˜ 120, VBE ˜ 0.7v). Use a supply voltage of 10 volts, and a source resistance of 15 KΩ. Estimate the DC bias voltages and currents, and compare these with the results of a computer simulation. Determine the small signal voltage gain.

Complementary Pair Example (1)

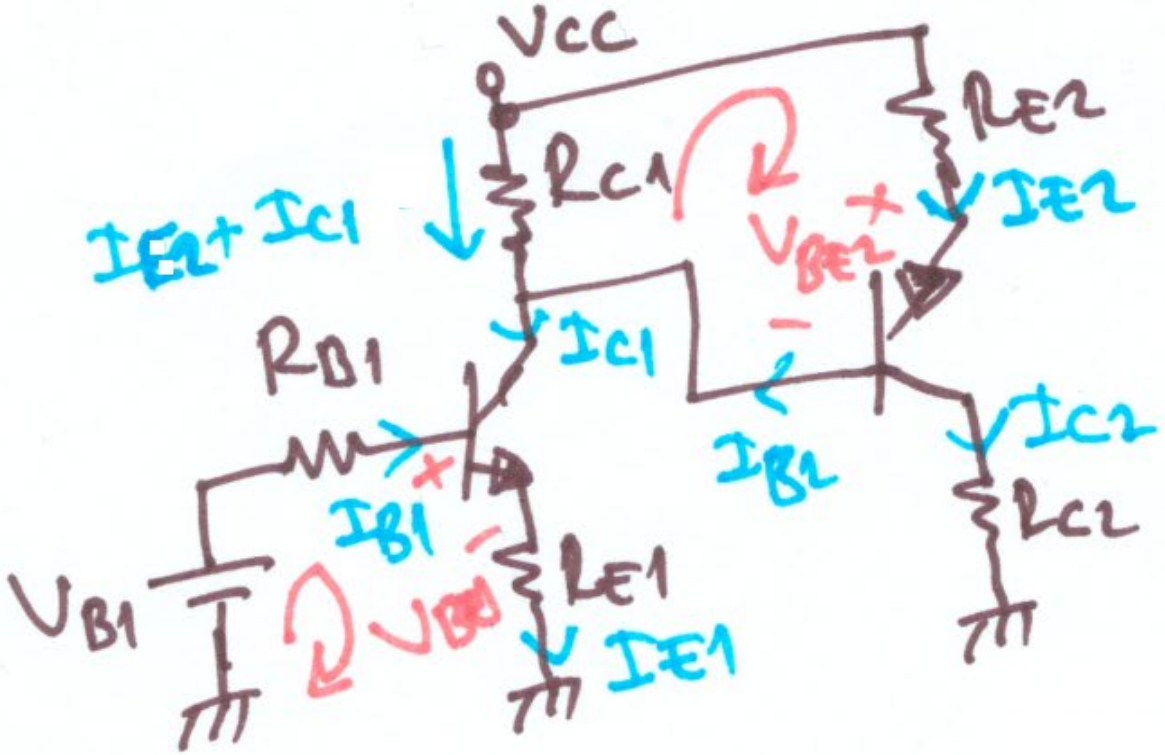


Complementary Pair Example (2)

#1: DC Analysis:

$$R_{B1} = R_1 /\!/ R_2 = \frac{R_1 \cdot R_2}{R_1 + R_2}$$

$$V_{B1} = \frac{R_2}{R_1 + R_2} \cdot V_{CC}$$



Complementary Pair Example (3)

$$I_{B1} = \frac{V_{B1} - V_{BE1}}{R_{B1} + (\beta_1 + 1) \cdot R_{E1}} \Rightarrow I_{E1} = (\beta_1 + 1) \cdot I_{B1} \Rightarrow r_{e1} = \frac{26\,mV}{I_{E1}\,mA}$$

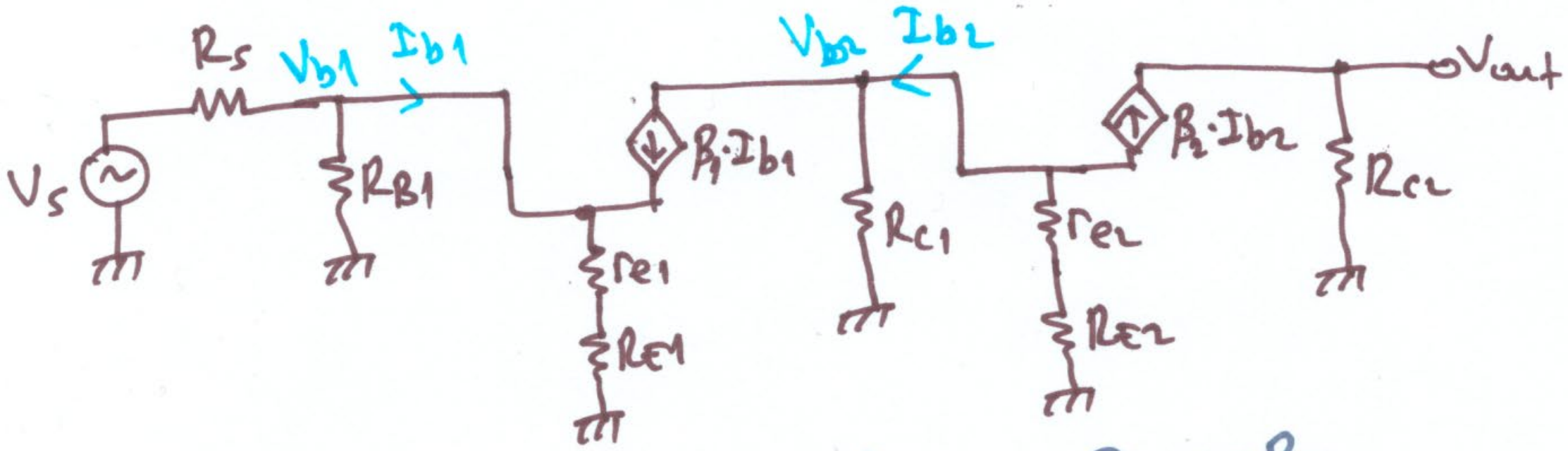
$$I_{C1} = \beta_1 \cdot I_{B1}$$

$$-(I_{E2} + I_{C1}) \cdot R_{C1} + R_{E2} \cdot I_{E2} + V_{BE2} = 0$$

$$I_{E2} = \frac{R_{C1} \cdot I_{C1} - V_{BE2}}{R_{E2} - R_{C1}} \Rightarrow r_{e2} = \frac{26\,mV}{I_{E2}\,mA}$$

Complementary Pair Example (4)

#2: AC Analysis:



$$z_{in} = R_{B1} \,//\, ((\beta_1+1)\cdot(r_{e1}+R_{E1}))$$

$$z_{out} = R_{C2}$$

Complementary Pair Example (5)

$$V_{out} = (\beta_2 \cdot I_{b2}) \cdot R_{c2}$$

$$I_{b2} = -\frac{V_{b2}}{(\beta_2+1)\cdot(r_{e2}+R_{e2})}$$

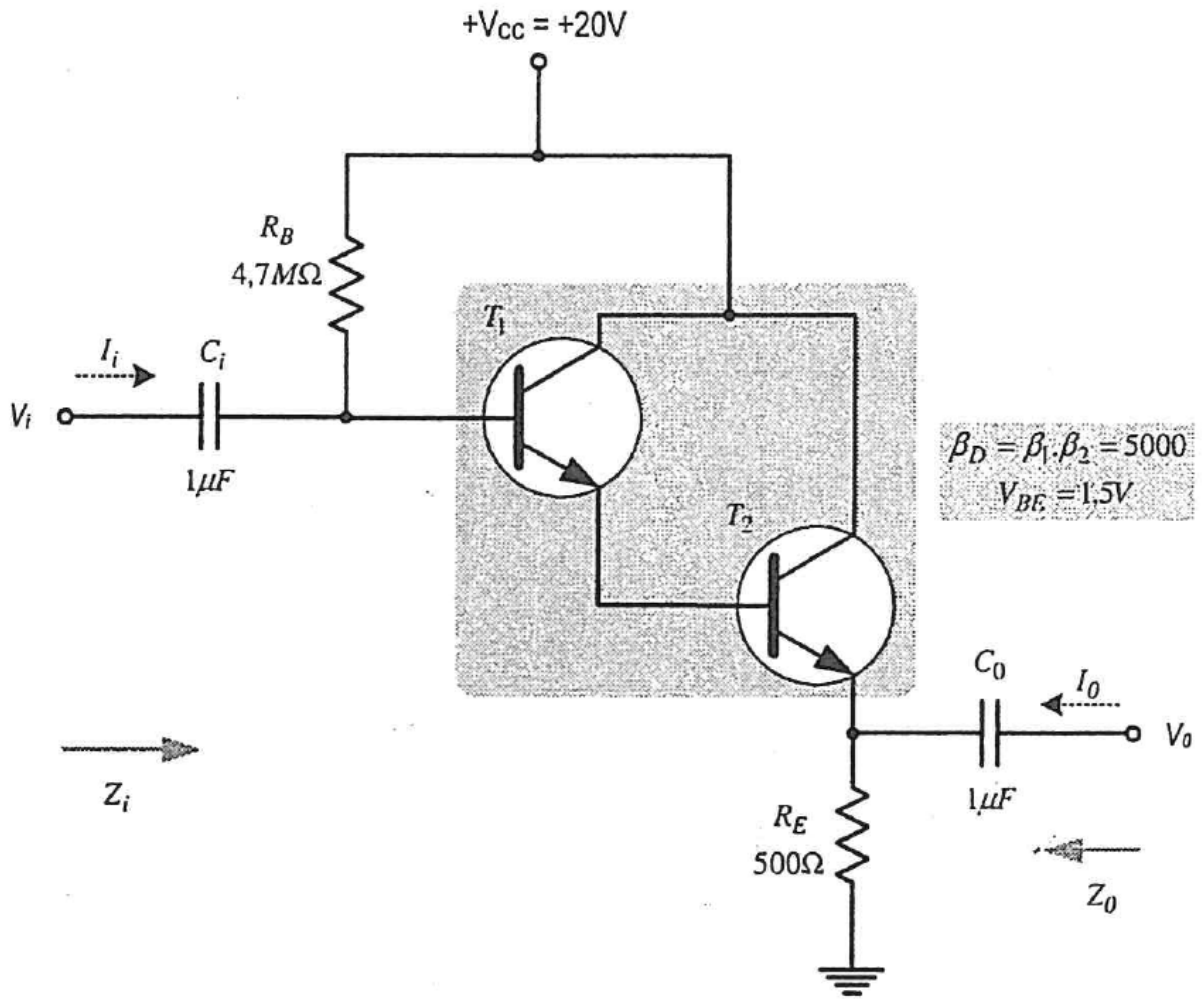
$$V_{b2} = -(\beta_1 \cdot I_{b1}) \cdot \left(R_{c1} \,/\!/\, \left((\beta_2+1)\cdot(r_{e2}+R_{e2})\right)\right)$$

$$V_{b1} = I_{b1} \cdot \left((\beta_1+1)\cdot(r_{e1}+R_{e1})\right)$$

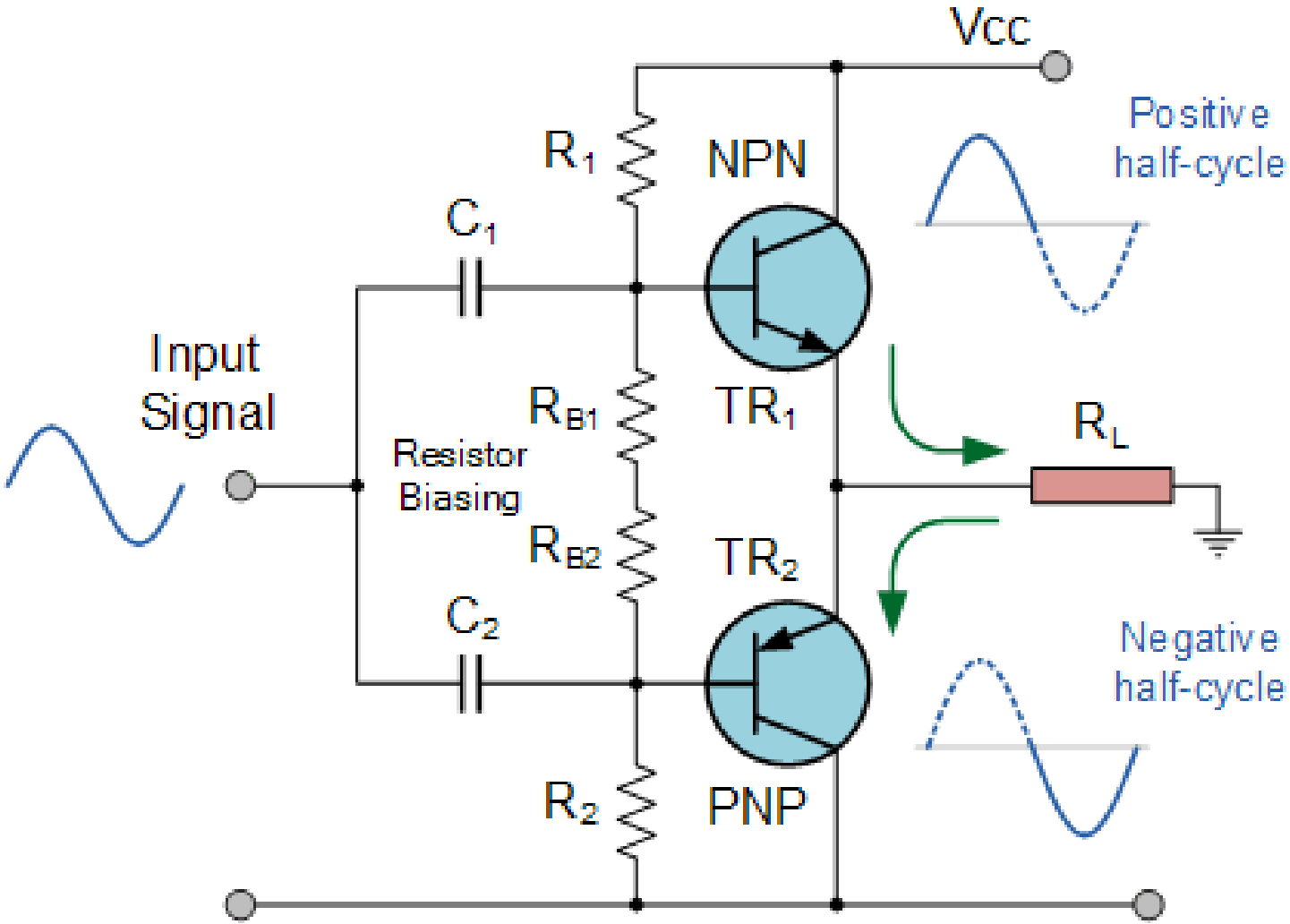
$$A_v = \frac{V_{out}}{V_{b1}}$$

$$A_{vs} = \frac{V_{out}}{V_s} = \frac{z_{in}}{z_{in}+R_s} \cdot A_v$$

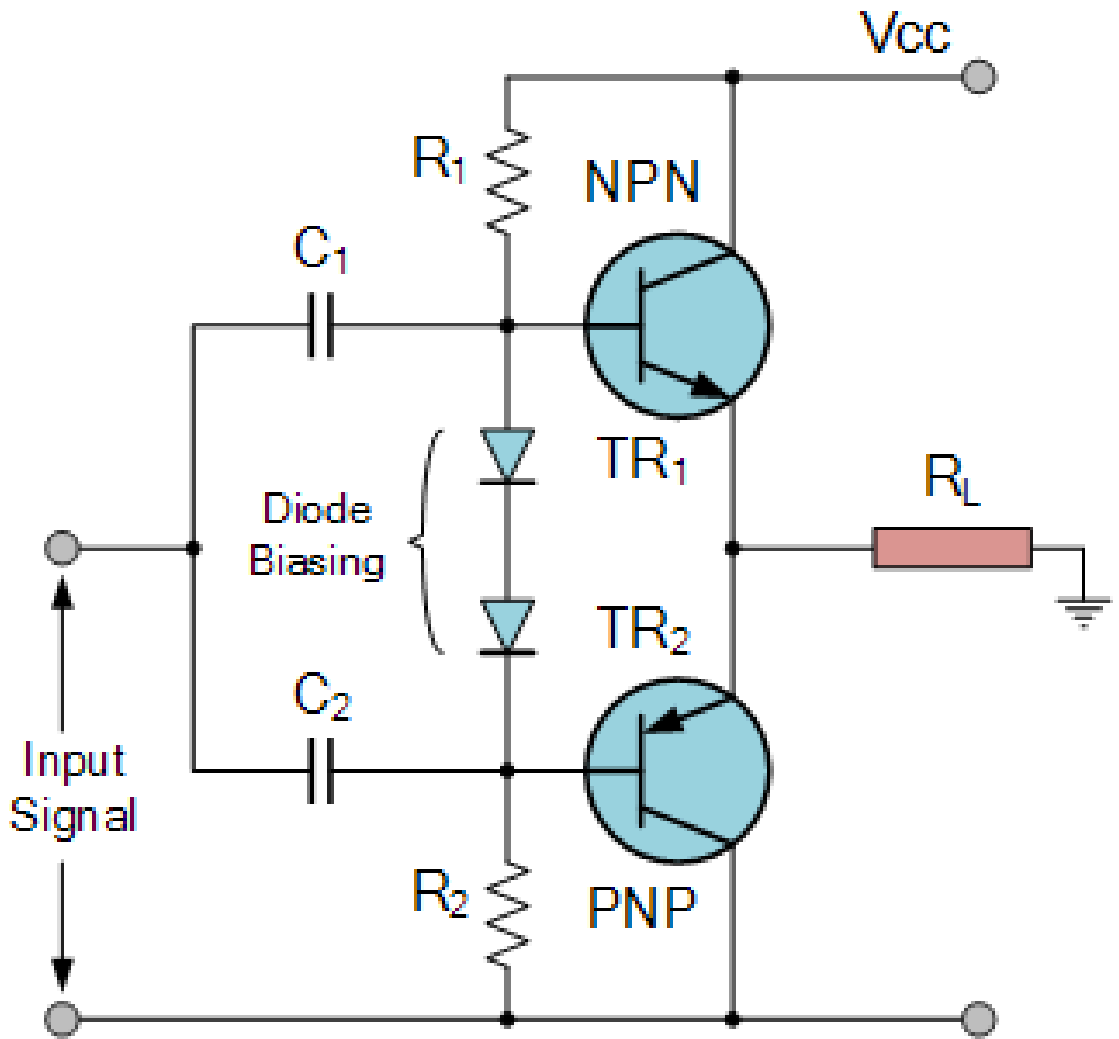
Darlington Connection



Class B Power Amplifier



Class AB Power Amplifier



Thanks for listening ☺

YALÇIN İŞLER

Assoc. Prof.