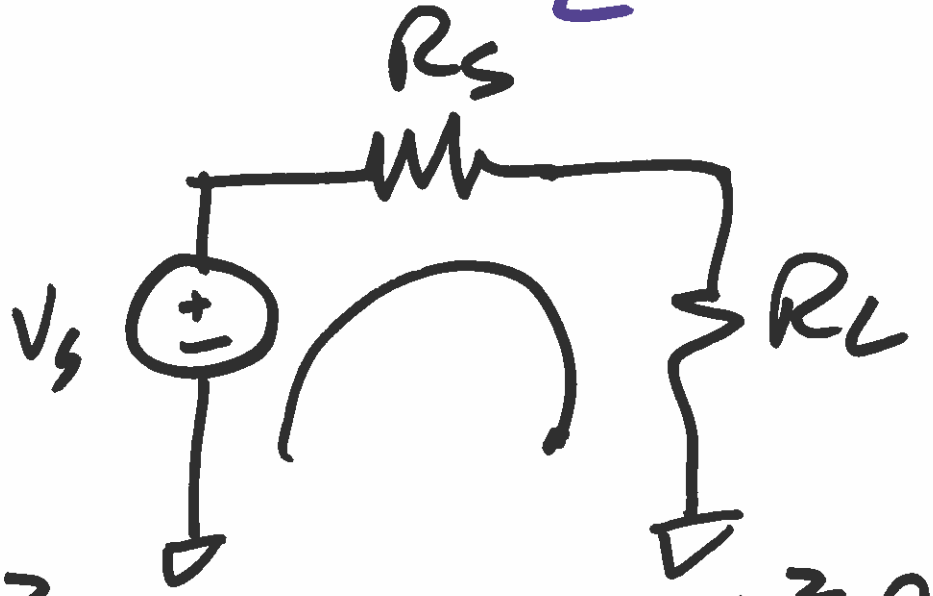
EE220 Circuits 1

Dec. 4, 2019

Lecture 27



$$I = \frac{V_S}{R_S + R_L}$$

$$P_L = I^2 R_L$$

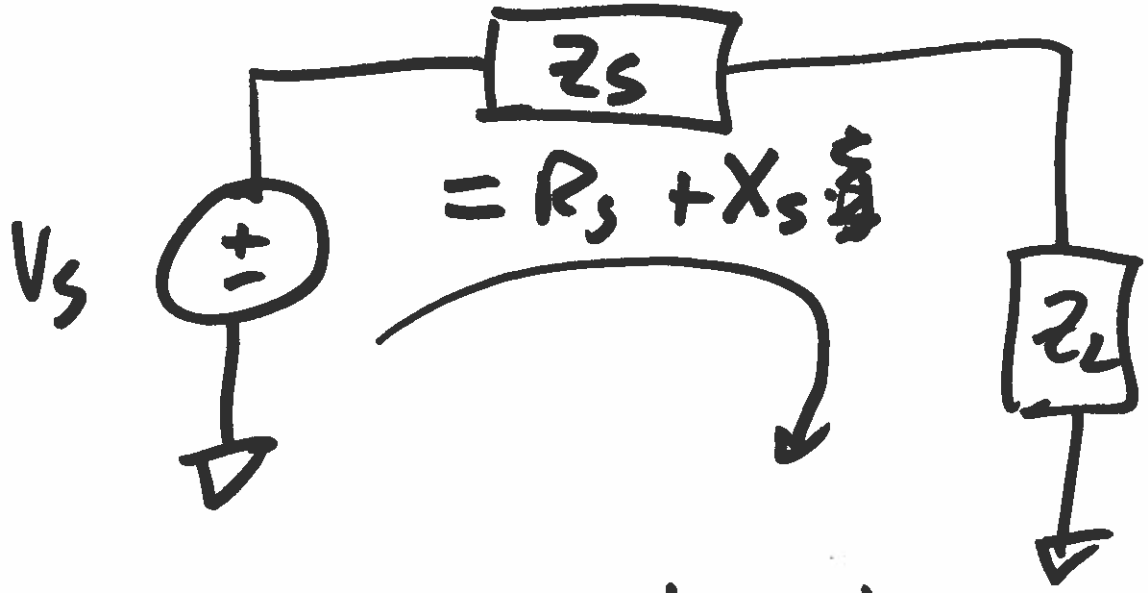
$$\frac{V_S^2}{R_S^2 R_L^{-1} + 2R_S + R_L} = \frac{V_S^2 R_L}{R_S^2 + 2R_S R_L + R_L^2} = \frac{V_S^2 \cdot R_L}{(R_S + R_L)^2}$$

$$\frac{d}{dR_L}\left(R_S^2 R_L^{-1} + 2R_S + R_L\right) = 0$$

$$(-1)\cdot R_S^2 R_L^{-2} + 0 + 1 = 0$$

$$\frac{R_S^2}{R_L^2} = 1$$

$$\boxed{R_S = R_L}$$



$$|I| = \frac{|V_S|}{|Z_S + Z_L|}$$

$IP = |I|$

$$I_{rms} = \frac{I_P}{\sqrt{2}} = \frac{|I|}{\sqrt{2}}$$

$$P_L = I_{rms}^2 \cdot R_L = \frac{1}{2} \cdot \frac{|V_S|^2}{|Z_S + Z_L|^2} \cdot R_L$$

$$= \frac{1}{2} \frac{|V_S^2| \cdot R_L}{\left((R_S + R_L) + (X_S + X_L)\right)^2}$$

2)

$$P_L = \frac{1}{2} \frac{|V_s|^2 \cdot R_L}{\sqrt{(R_s + R_L)^2 + (X_s + X_L)^2}}$$

$a + jb$

$a - jb$

$$X_s = -X_L$$

X_s is the complex conjugate of X_L

MAX power transfer

$$X_L = 500 + j50$$

$$X_s = 500 - j50$$

$$\frac{a-jb}{a^2+b^2} = \frac{1}{a+jb}\cdot\frac{a-jb}{a-jb}$$

$$x+jy$$

$$\sqrt{x^2+y^2} = |1|$$

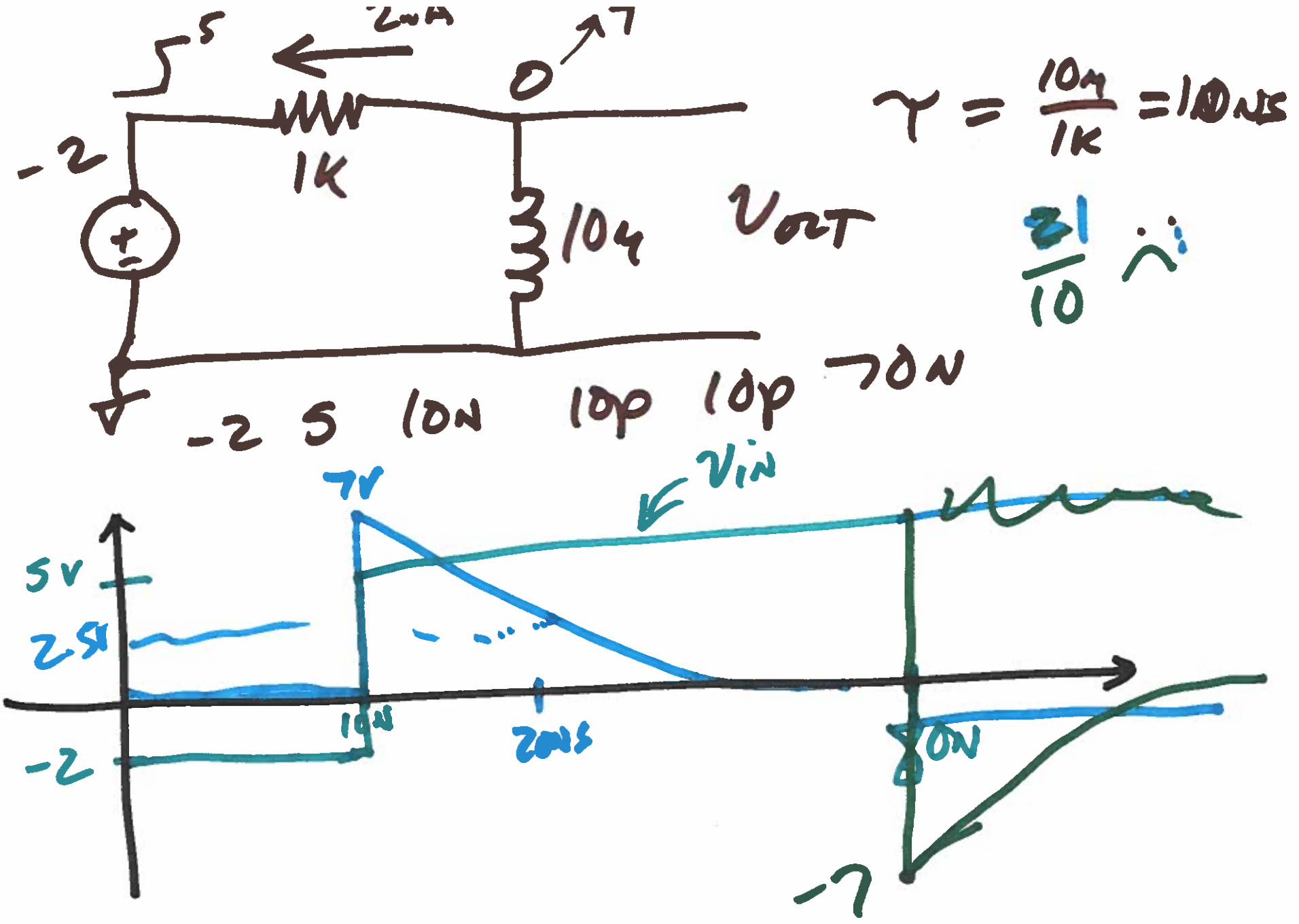
$$\frac{a}{a^2+b^2} + j\frac{-b}{a^2+b^2} = \sqrt{\left(\frac{a}{a^2+b^2}\right)^2 + \left(\frac{-b}{a^2+b^2}\right)^2}$$

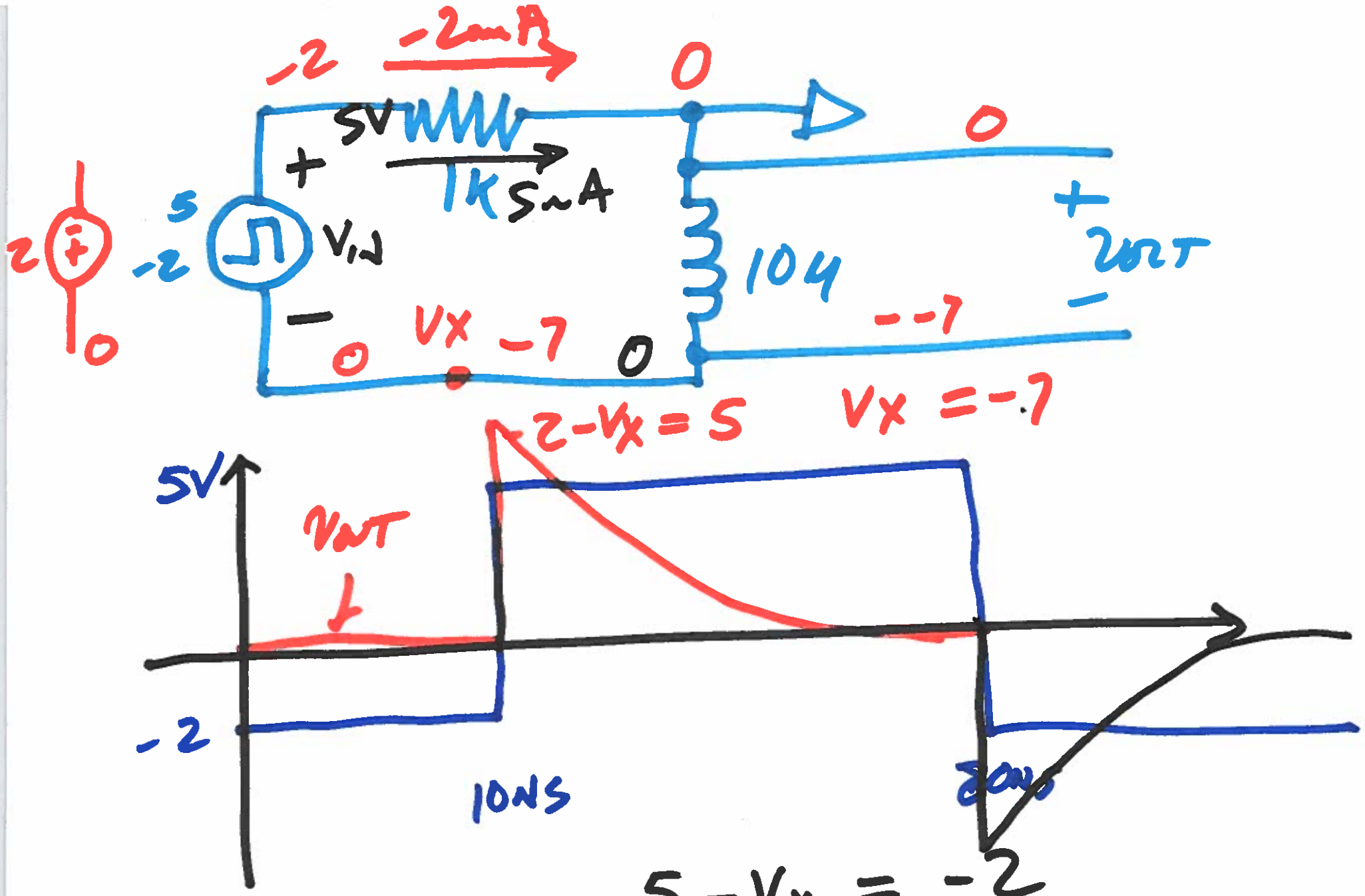
$$\angle \tan^{-1}\frac{y}{x}$$

$$\angle \tan^{-1}\frac{-b/a^2+b^2}{a/a^2+b^2} = \tan^{-1}\frac{-b}{a} = -\tan^{-1}\frac{b}{a}$$

$$\sqrt{\frac{a^2+b^2}{(a^2+b^2)^2}} = \frac{1}{\sqrt{a^2+b^2}}$$

5)


5
2mA
0
7
-2
1K
10μ
VOUT
-2 5 10N 10p 10p 70N
τ = 10μ/1K = 10NS
2/10
7V
VIN
5V
2.5V
-2
10N
20NS
70N
-7



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