P3360 / AEP 3630

Lecture 1

I. Bazarov

web site: blackboard.cornell.edu
↳ TA info, office hours, etc.

Texts: E. Kirkland and R. Littauer, Lab Manual
I. Bazarov, Supplement

Labs: 401 MW 7:30PM - 10:30PM
402 TR 1:25PM - 4:25PM

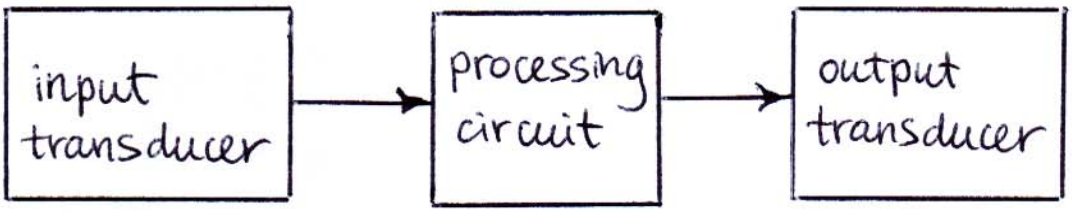
HW: 1 each week, due next week (Friday)
no late HW accepted

Grade: 35% lab

More info: Blackboard, printouts, 1st lab (!)

Goals: -
-
-

Typical Electronic Device



transducer :

input transducer :

output transducer :

Two types of circuits

info is represented by

typical functions :

Q: possible problems ?

input / output signals have

typical fcn :

Basic quantities of interest

V = voltage =

I = current =

DC :
AC :

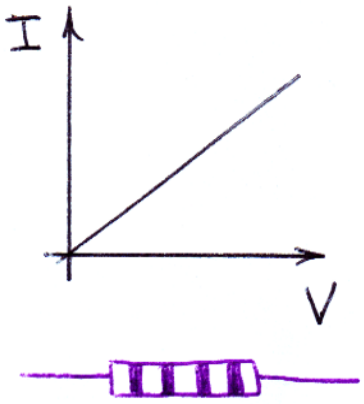
Convention I, V –
i, v –

I, V - represent

Electric circuit –

Linear circuit devices

① Resistor obeys Ohm's law

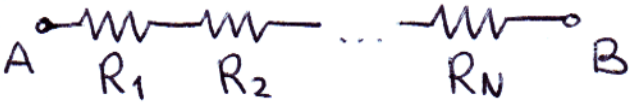


I-V curve $R \neq f(I,V)$

Black	0	n/a - 20%
Brown	1	silver - 10%
R	2	gold - 5%
O	3	
Y	4	
G	5	
B	6	
V	7	
Gray	8	
White	9	

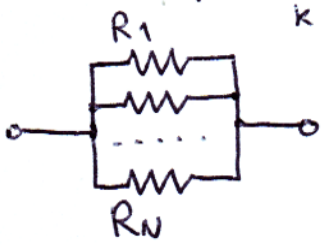
Conductance = inverse resistance

Series resistors

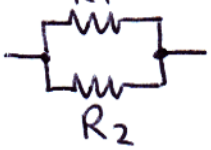


$$R_T = \sum_k R_k$$

Parallel

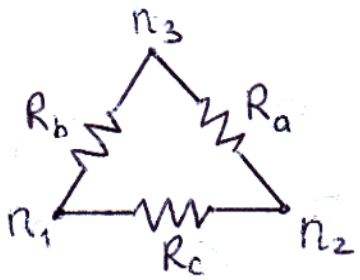


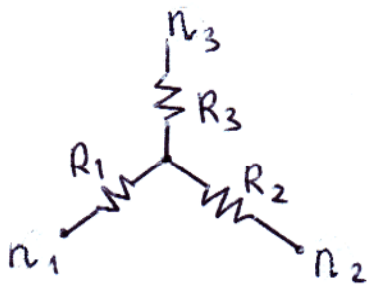
$$G_T = \sum_k G_k$$



Y-Δ transformation

Δ→Y :





Y→Δ :

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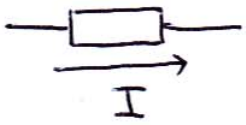
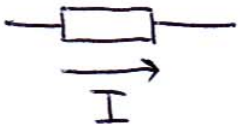
Lecture 2

Power



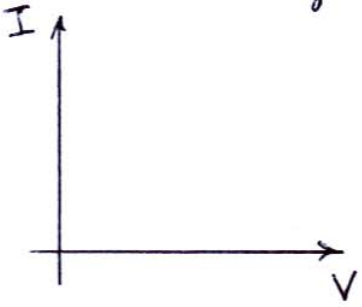
instantaneous power



(2) Voltage source

or or

ideal voltage source holds
const voltage no matter what

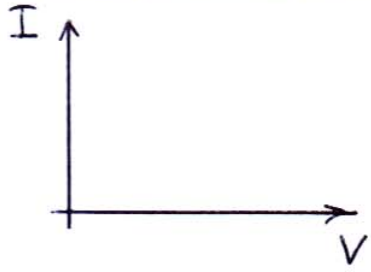


Practical volt. source voltage may not be const

③ Current source

or or

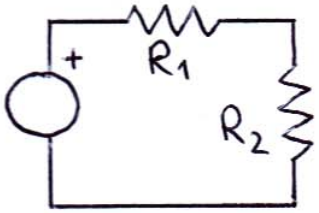
Ideal current source supplies const current no matter what



Practical current source

Circuit analysis

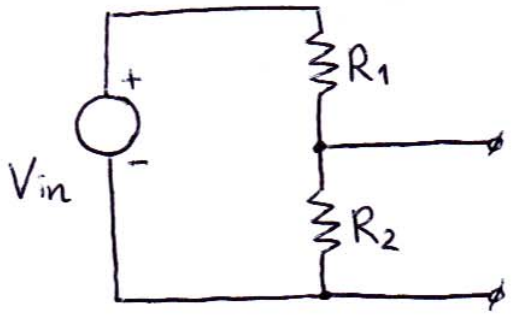
Kirchhoff's voltage law (KVL)



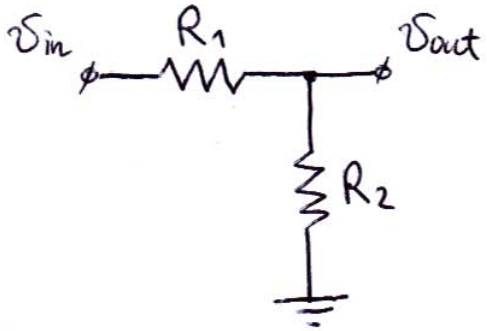
Kirchhoff's current law (KCL)

KVL & KCL are completely general

Voltage divider



A word on notations



Circuit simplifying techniques

Superposition

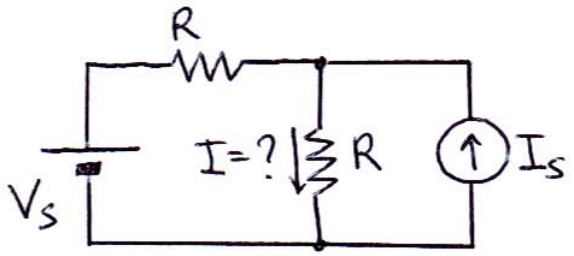
Given a _____ circuit containing several i_s, v_s, the total i, v at a given point is algebraic sum from _____ source.

step 1.

step 2.

step 3.

Ex.



Find I?

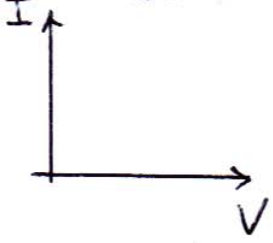
① open I_s

② short V_s

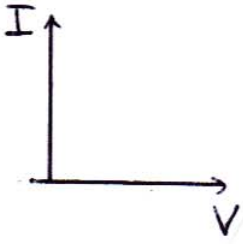
③ sum

Thevenin equivalent

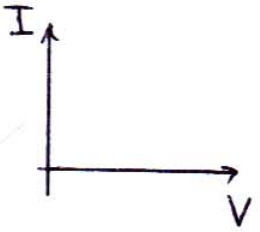
ideal v.s.

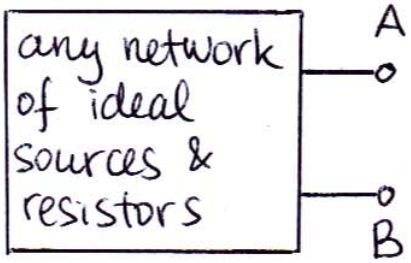


ideal c.s.



some R





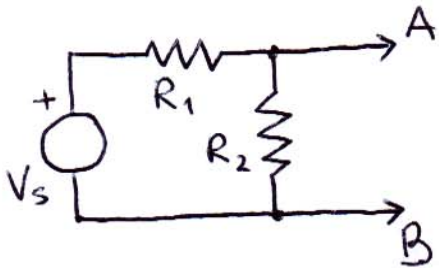
any combination of _____ circuit elements with two output terminals may be replaced with _____ and _____

V_{TH} =

R_{TH} =

Lecture 3

Thevenin th. - example



Useful trick: to find R_{Th}, short _____ and open _____. R_{Th} is resistance by looking inside the two terminals.

Norton equivalent

same as Thevenin but $\Rightarrow$

$I_N =$, $R_N =$

Linear time-dep. elements

Linear if KVL & KCL contain terms $\propto$

but never

④ Capacitor

2 parallel plates separated by insulator

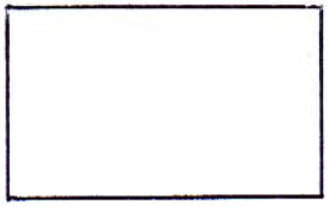
$Q =$

$[C] =$ farads

$C_{Total} =$

$V = \frac{Q}{C}$, $\Rightarrow$ $\frac{dV}{dt} =$

⑤ Inductors

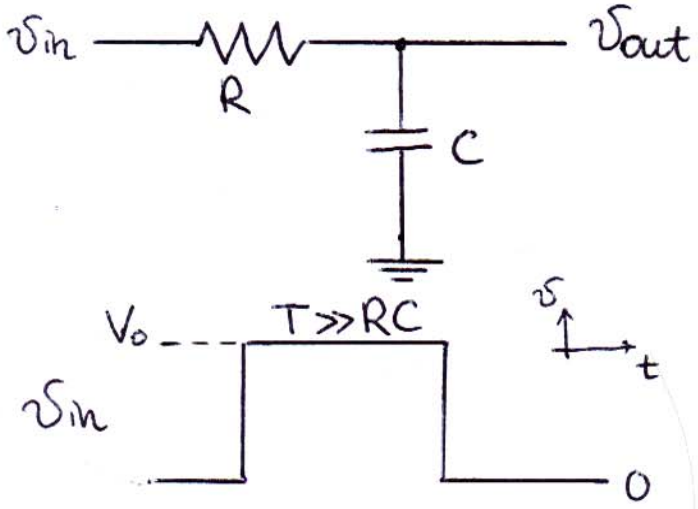


$[L] = \frac{V \cdot s}{A}$ = henries

L_{TOTAL} =

Bulky $\lesssim$ MHz, not routinely used

Low-Pass filter

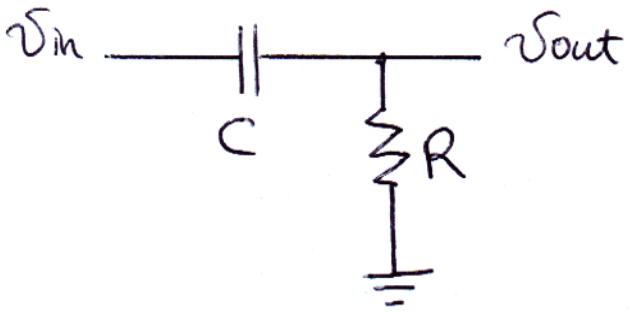


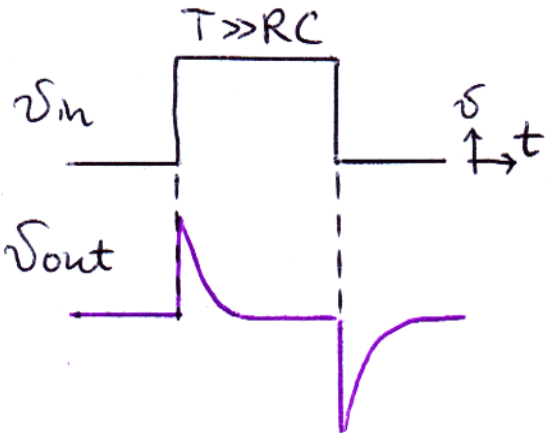
v_{out}

v_R

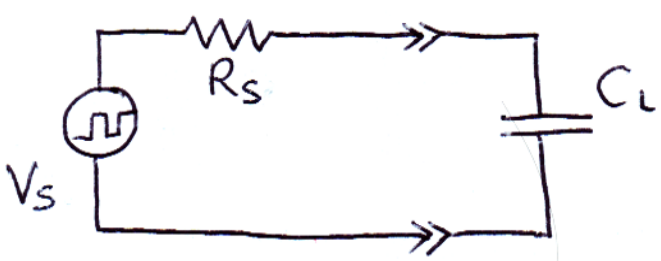
Piece of trivia:
v_c vs t after
step in voltage

High-pass filter

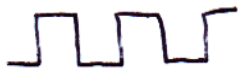




Exp I-10



Function generator produces  drives capacitive load C_L

input  ⇒ output

'Fake' large R_i by adding large R to f-generator.

Need to transmit shape. How?

Soln.