E151 Lecture 2 – Thevenin and 2 Port Hacks

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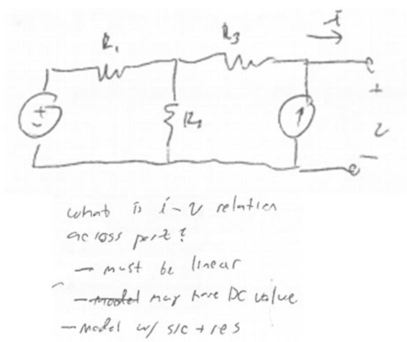
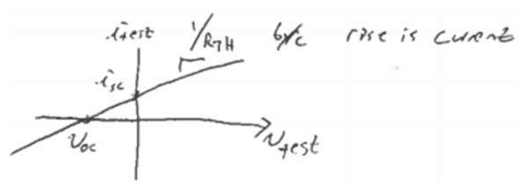
Disclaimer

These are note for Prof. Spencer to give the lecture, they were not intended as a reference for students. Students asked for them anyway, so I’m putting them up as a courtesy. Remember that they are not intended as a substitute for lecture.

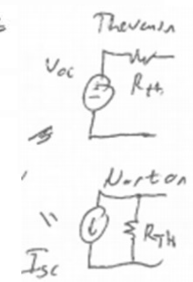
Thevenin

- Don’t care about circuits floating in space – want to connect them
- Connecting them to stuff can cause loading, need i-v relationships
- Place we make a connection called a port (where we apply vt) eg:



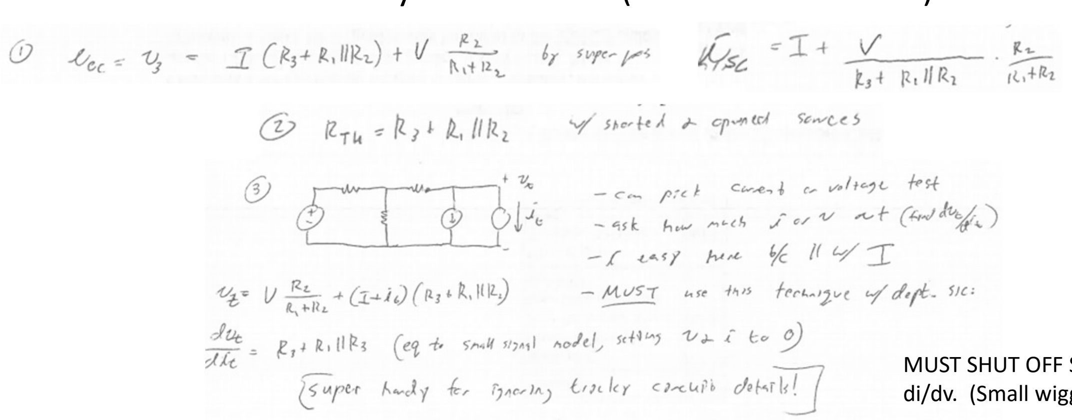


Norton is V-I curve instead of I-V



Example Find Thevenin Impedance 2 Ways

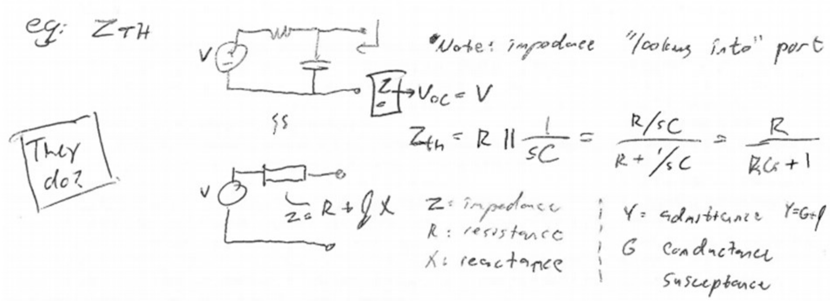
- Options: voc/isc (slope), simplify network (offset & resistor model)
- Then I show 3rd way: test sources (derivative of circuit)



MUST SHUT OFF SOURCES for di/dv. (Small wiggles go to die)

Odds and Ends

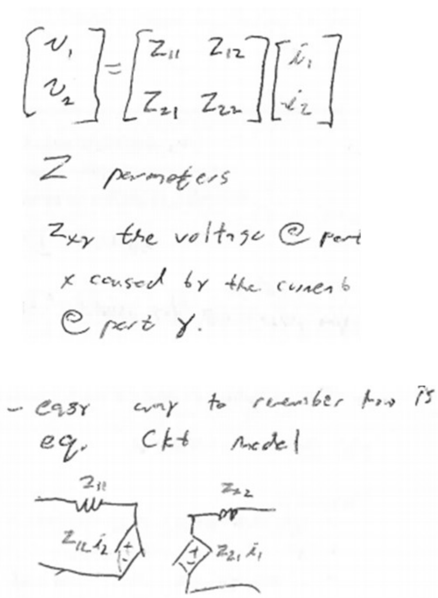
- Non-resistive impedances?
  - Just fine, have a Zth (general case) rather than Rth (like homework)



- What if no sources? In quadrants 1&4, dissipative, called "passive"

What are 2 ports?

- 2 port devices are common and useful: eg
  - Dividers, Transformers, Amplifiers, Wires
- 2 ports don't have Thevenin resistances, instead defined by matrices
  - Needs linearity and passivity to work
- (Explain link to model quickly)
- Try to avoid b/c lots of matrix math
  - Become 1 ports if you know the load
  - Later we'll approximate Z12=0 for amplifiers
  - In other classes, use b/c easy to measure



Dynamics Review – Initial and Final Values

- What do we want to know dynamics responses to?
  - Sines → transfer functions work great
  - Steps → … time domain, need some trick
  - Ramps → integrated steps, next
  - Exponentials → basically ramps, next
- We can get time domain responses from xfer fn with IVT/FVT

– IVT

$$\lim_{t \to 0} f(t) = \lim_{s \to \infty} sF(s)$$

– FVT

$$\lim_{t \to \infty} f(t) = \lim_{s \to 0} F(s)$$

Don't forget that LT F(s) implicitly involves initial condition, so the IC is added to IVT/FVT value