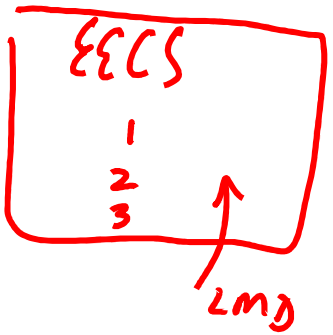
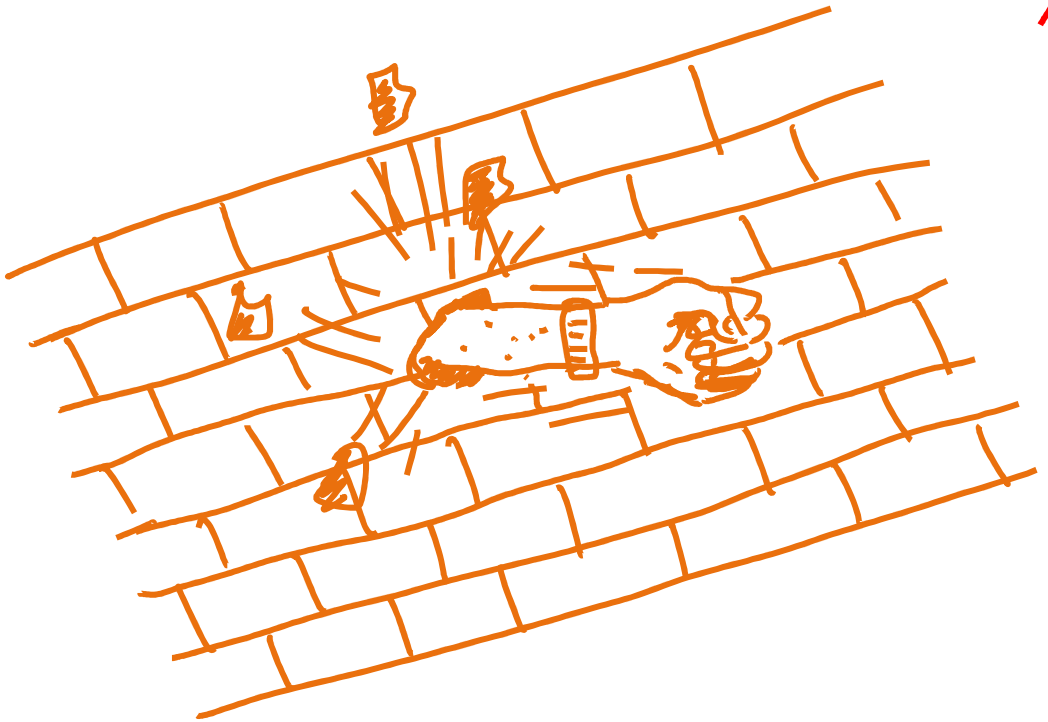
6.002x CIRCUITS AND ELECTRONICS



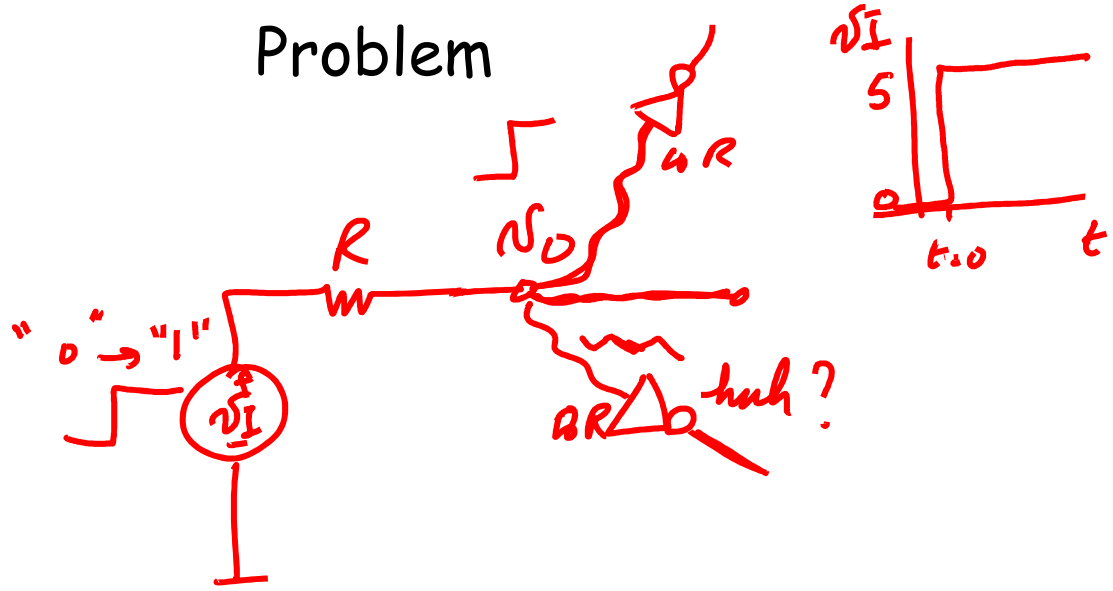
Violating the Abstraction Barrier

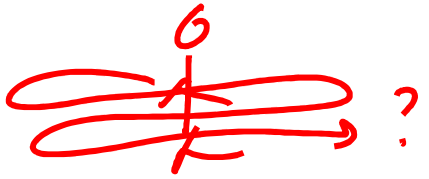


Case 1: The Double Take

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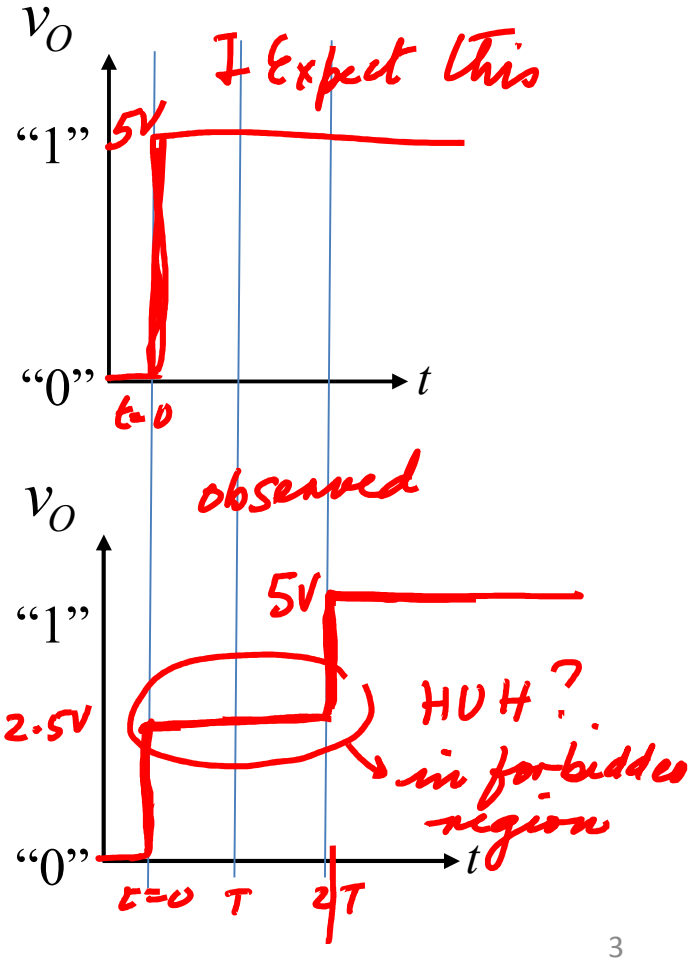
Problem





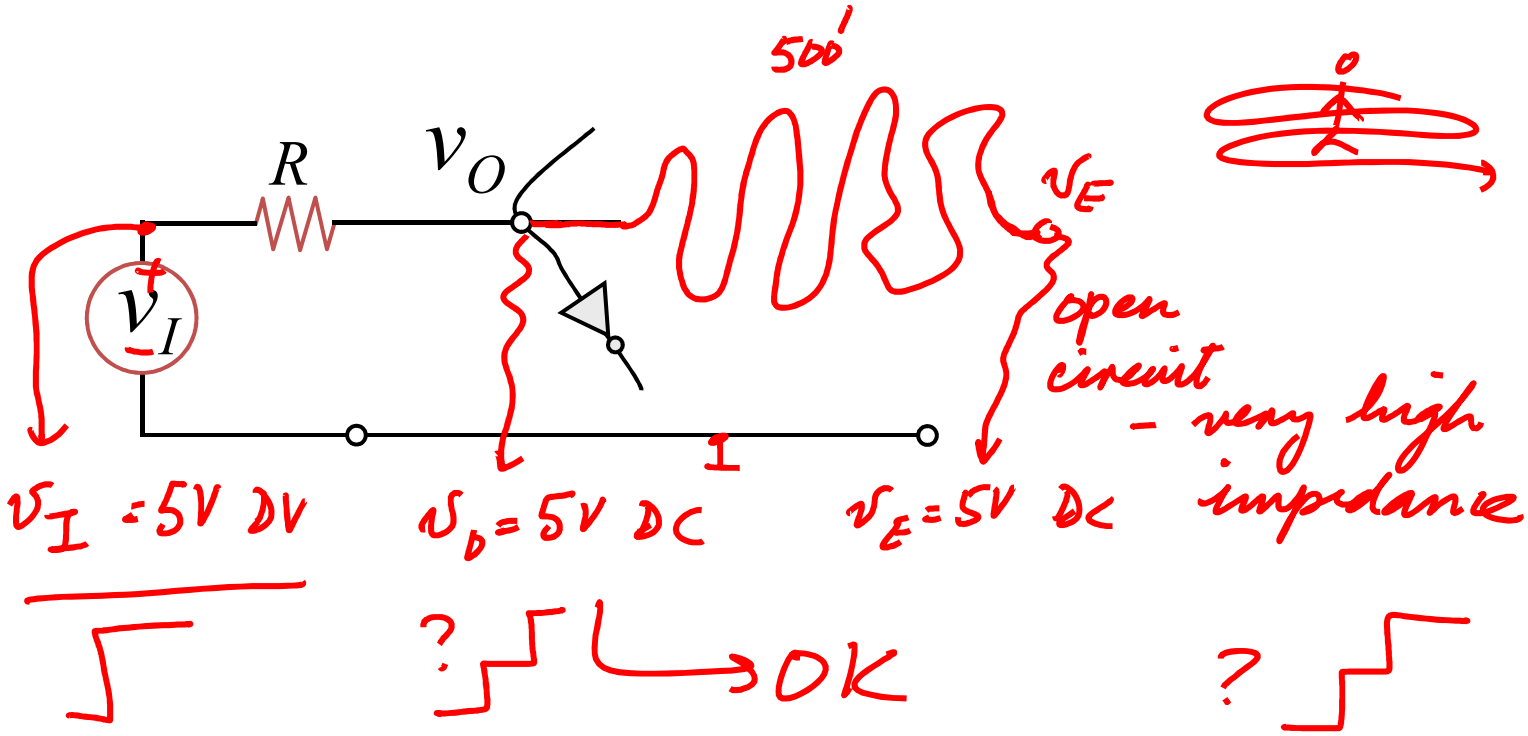
?

Demo

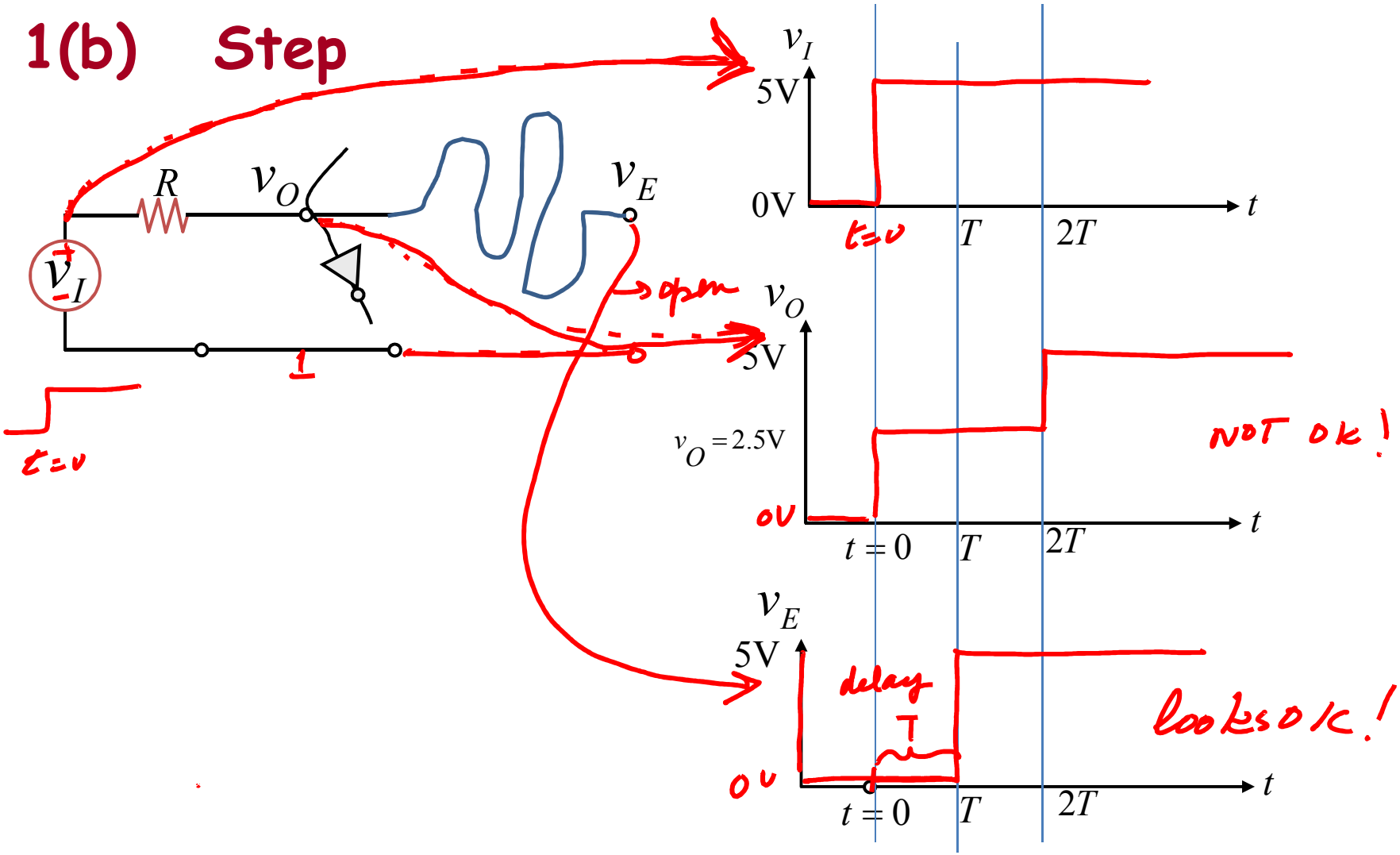


1(a) DC case

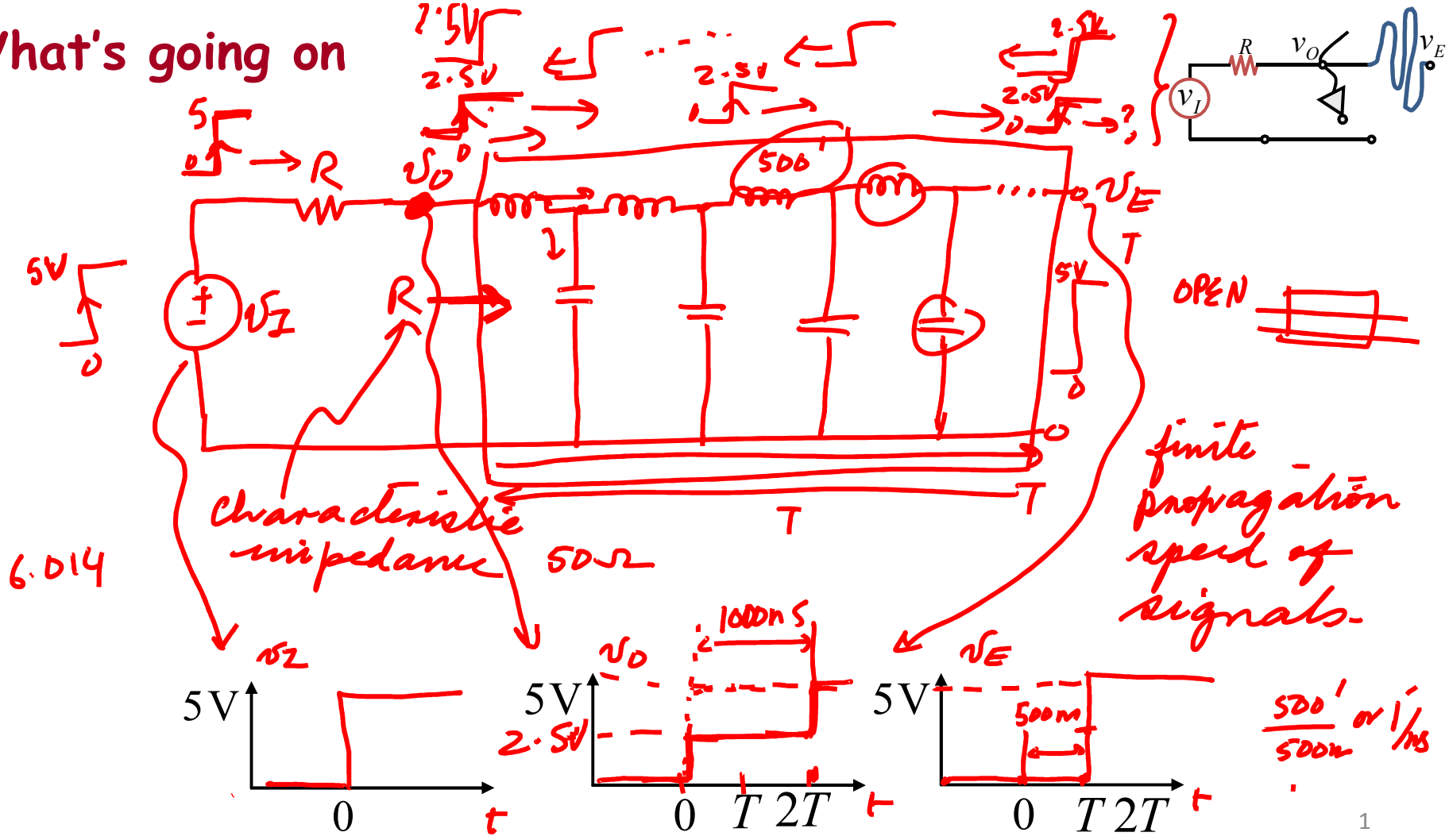
1 double lab

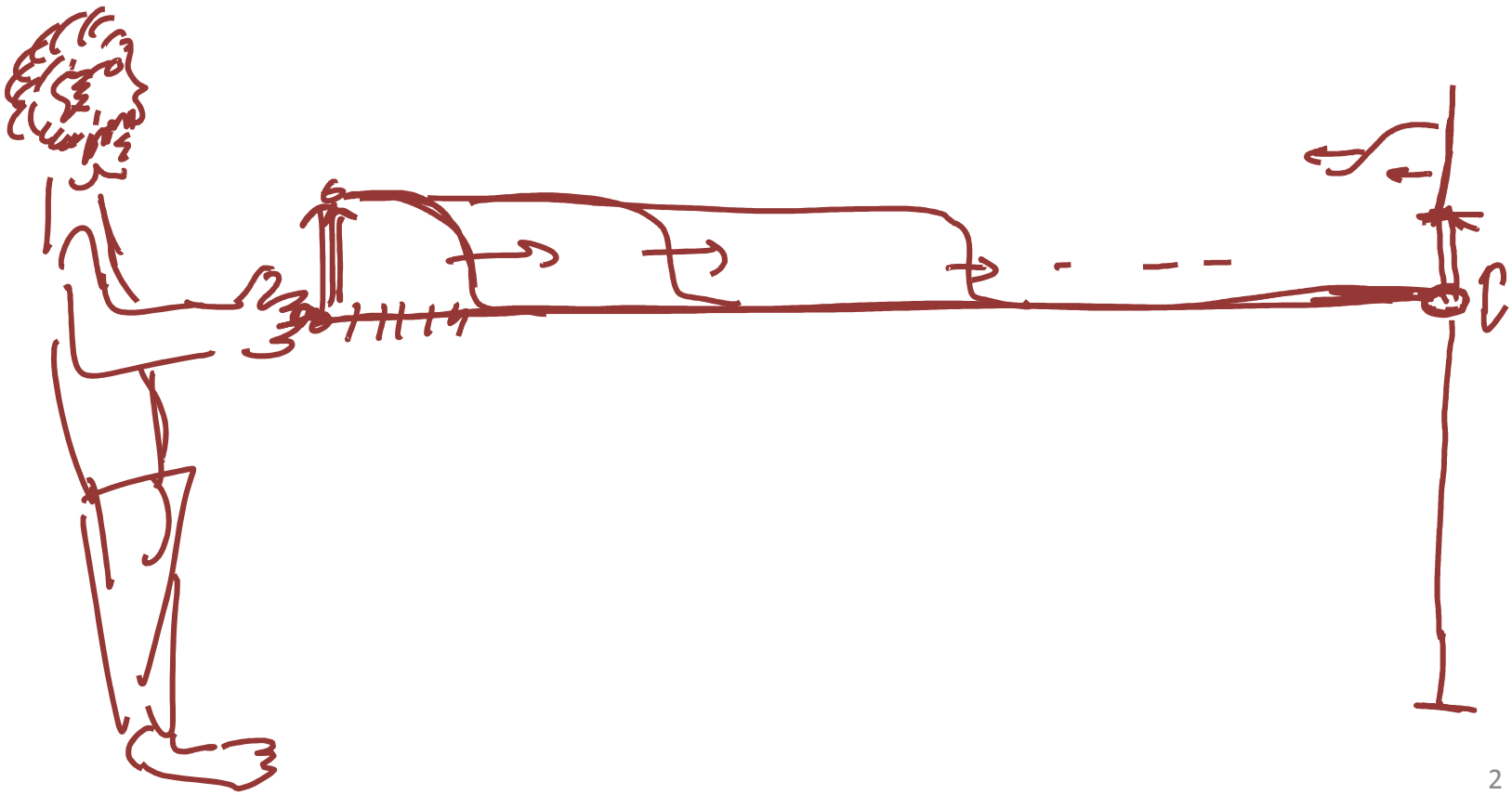


1(b) Step

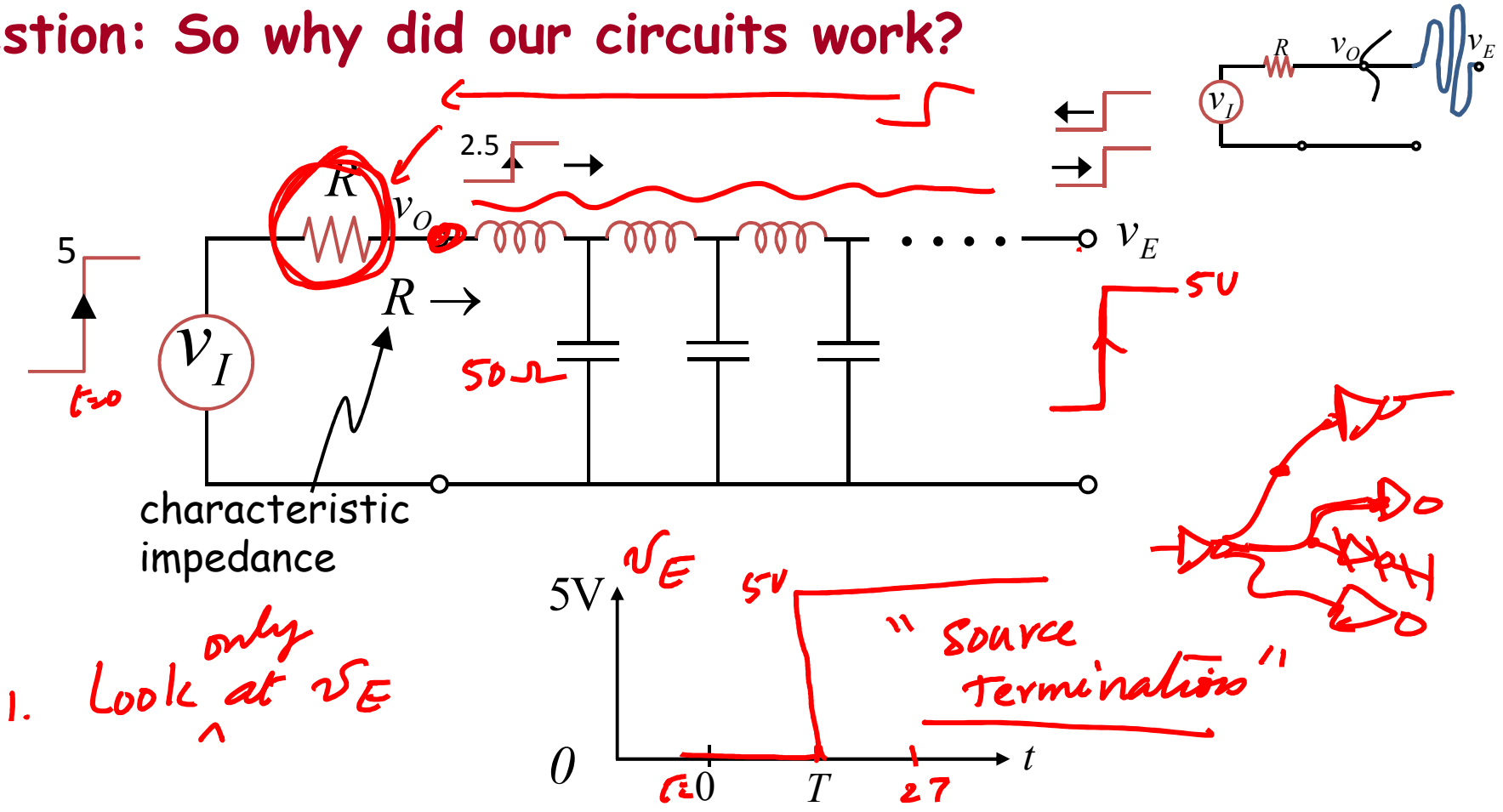

R
v_O
v_E
$\vec{v}_I$
1
t=0
v_I
5V
0V
t=0
T
2T
t
v_O
5V
$v_O = 2.5V$
0V
$t = 0$
T
2T
t
NOT OK!
v_E
5V
delay
T
0V
$t = 0$
T
2T
t
looks OK!

What's going on



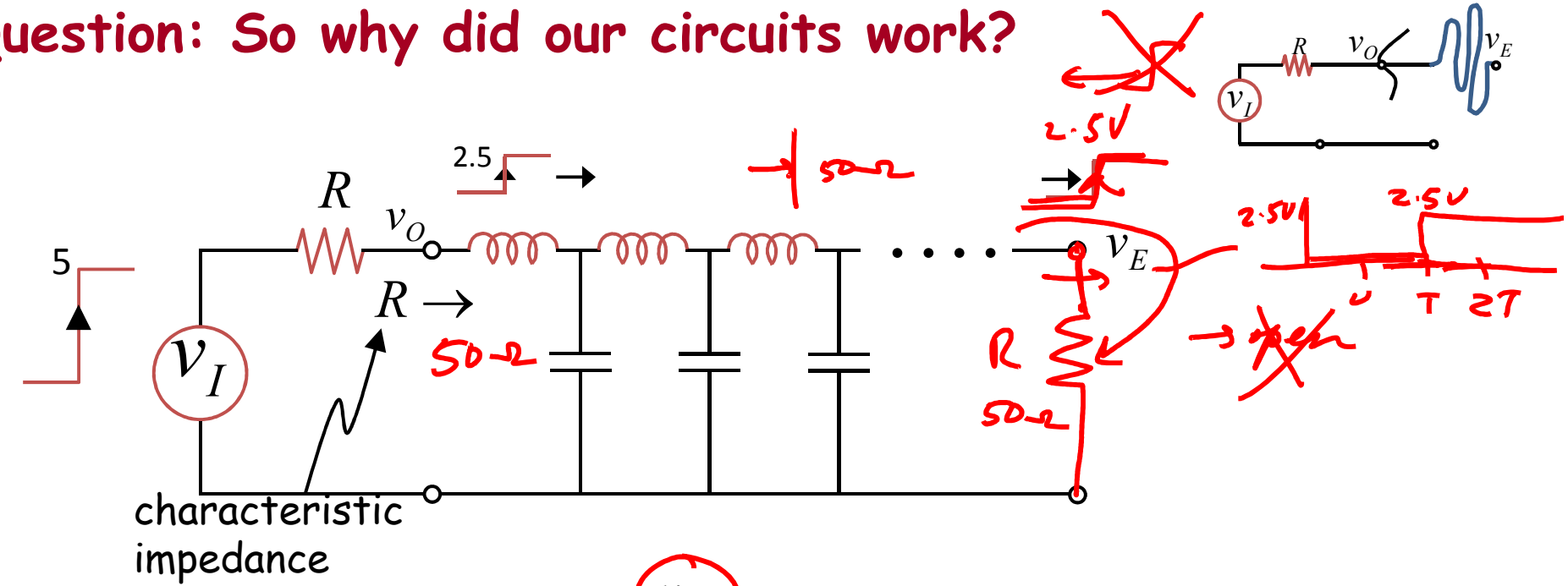


Question: So why did our circuits work?



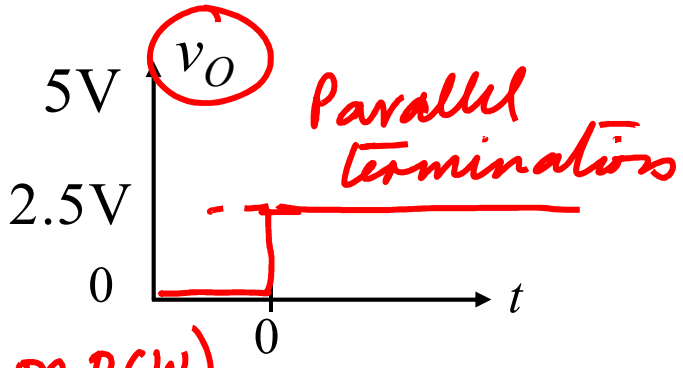
1. Look only at v_E

Question: So why did our circuits work?



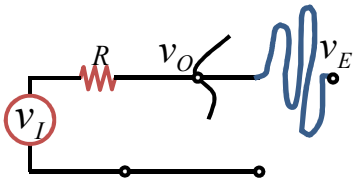
2. Termination → no reflection

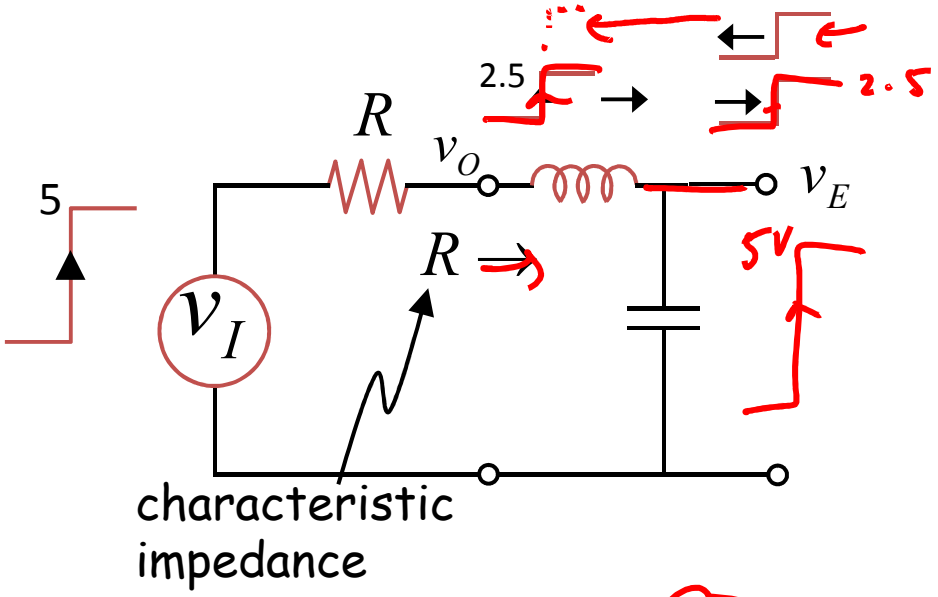
Move in 6.014 (or check out on OCW)



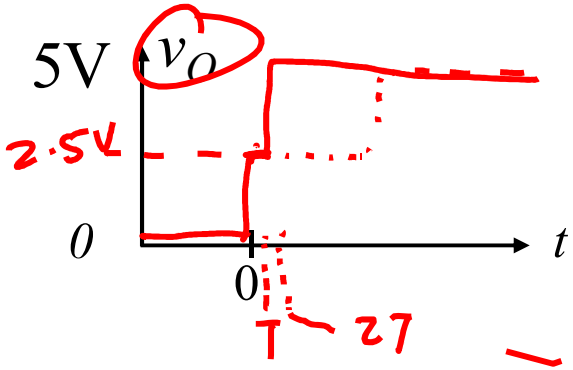
DEMO add R at the end

Question: So why did our circuits work?



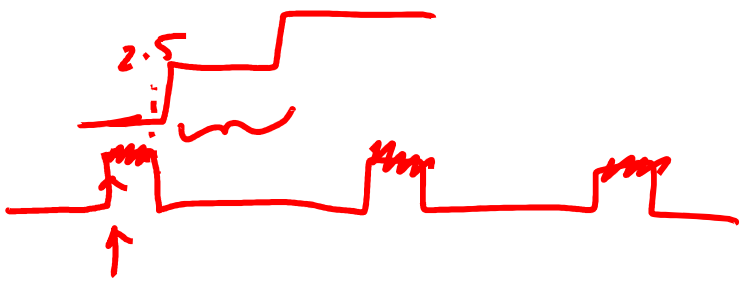


3. Keep wires short



DEMO
use small wire

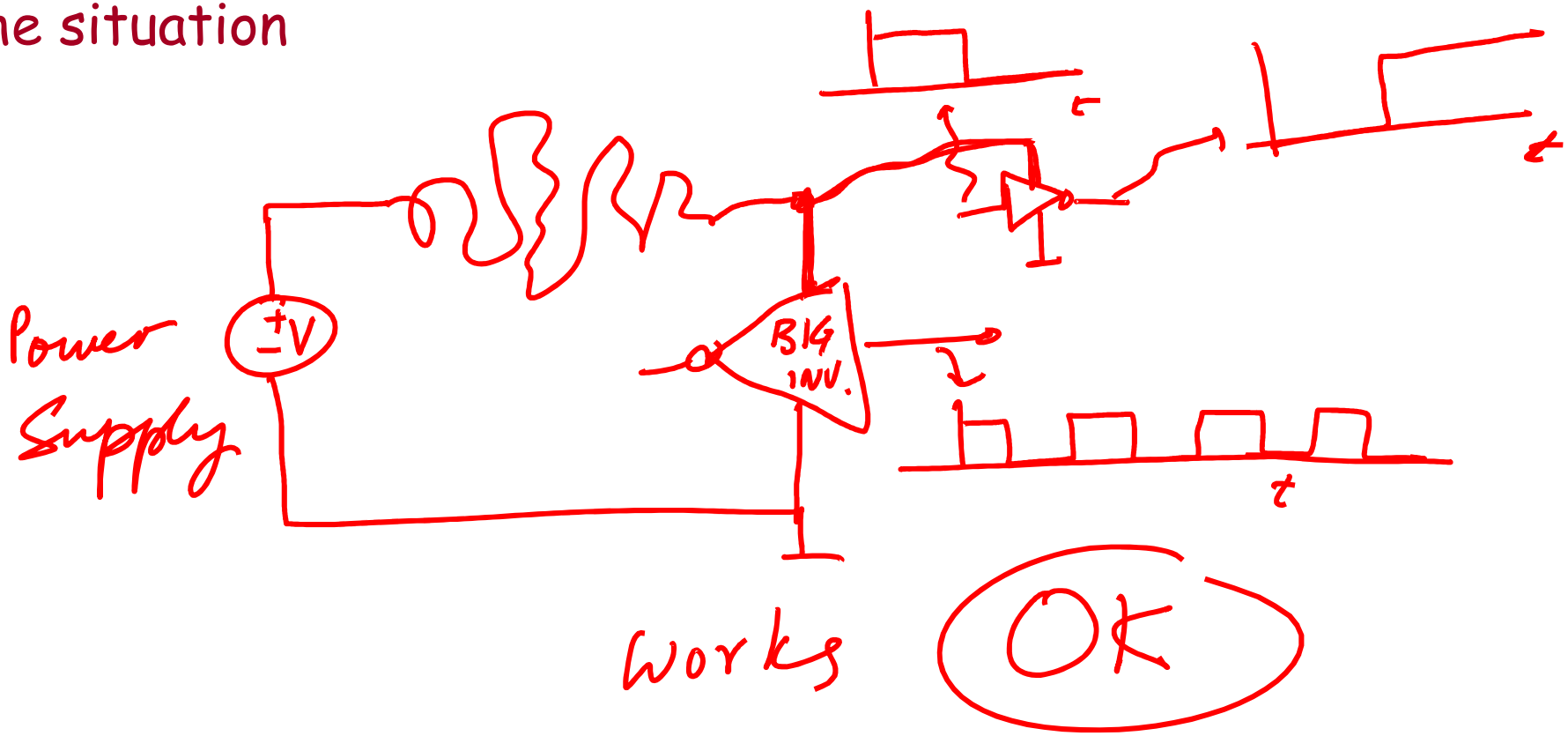
4. use a clock



Case 2: The Double Dip

Case 2: The Double Dip

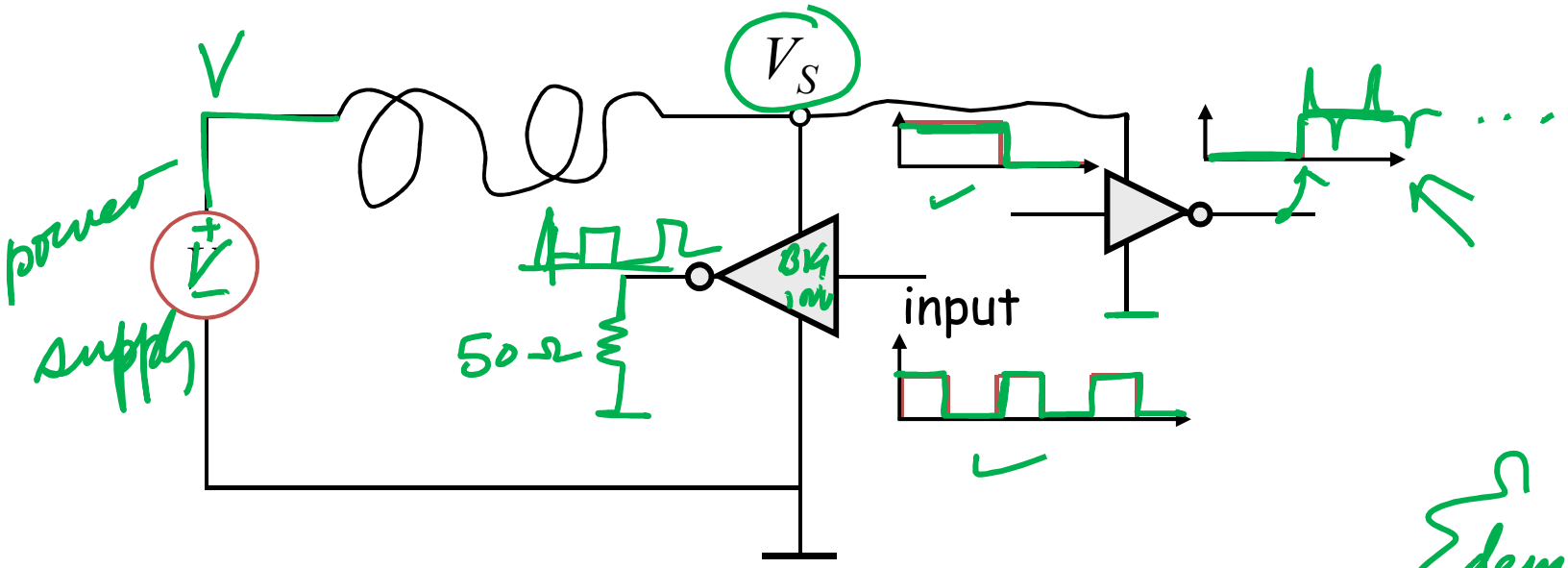
The situation



Works OK

Case 2: The Double Dip

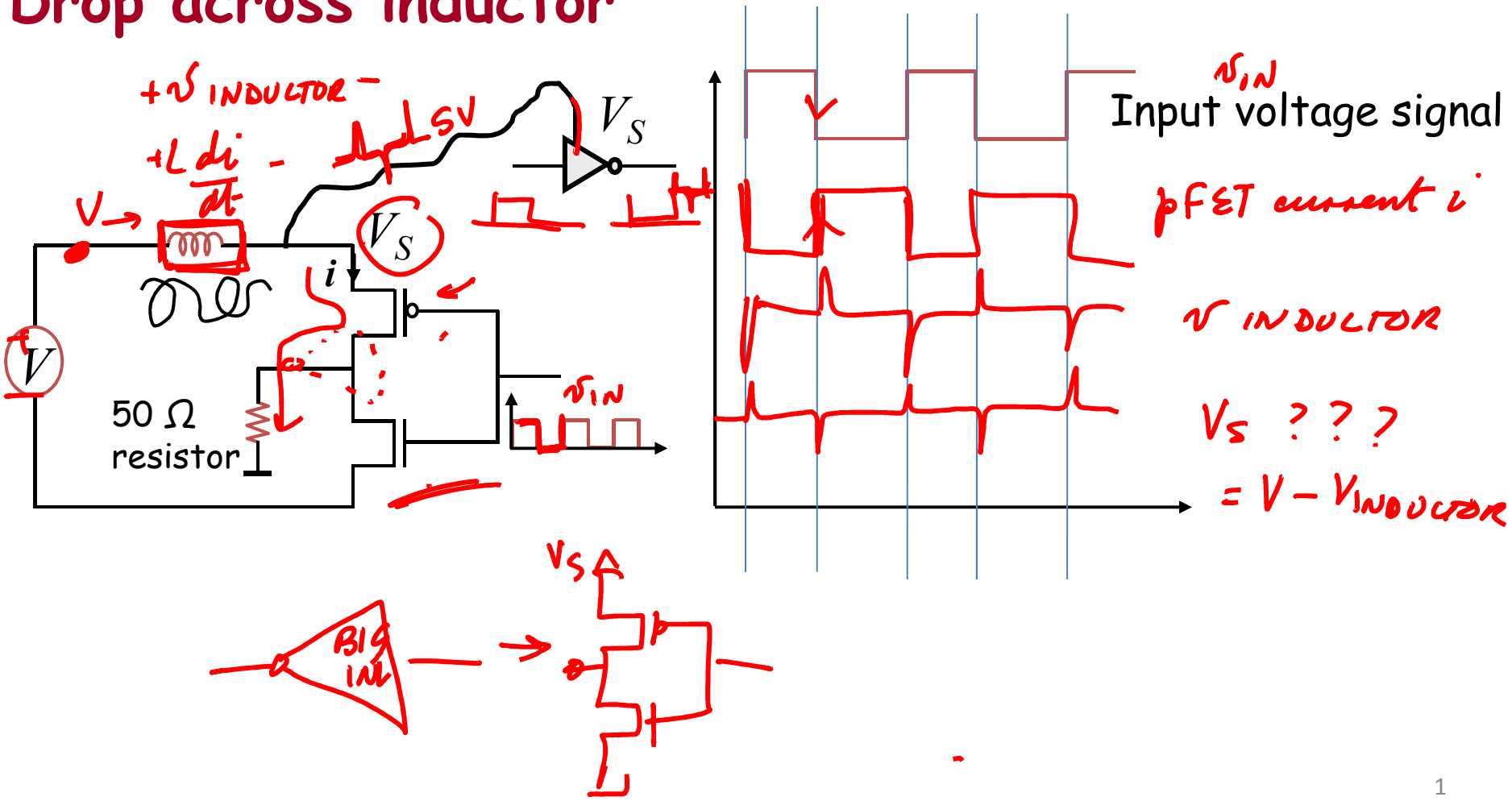
Problem → strange spikes on supply when we add a load resistor



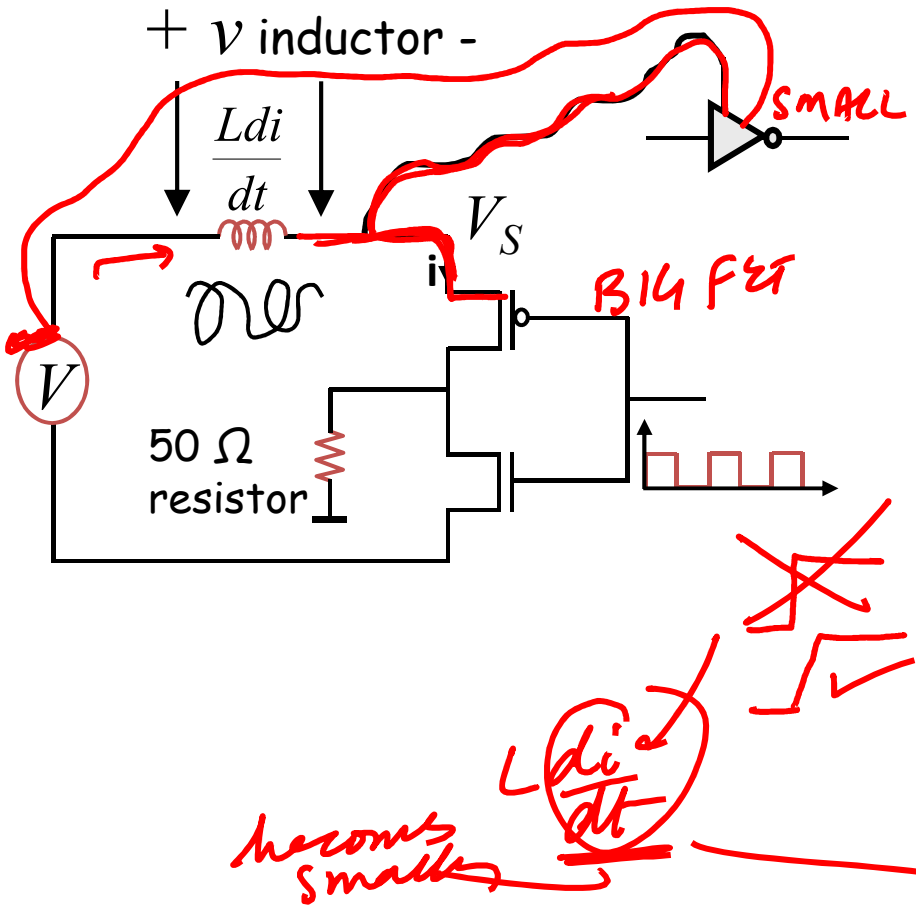
Why?

demo

Drop across inductor



Drop across inductor



Solutions (or why did our circuits work before)

1. Keep wires short
2. low inductance wire
3. Separate the power grids for high and low power circuits
4. avoid large current swings
5. avoid sharp transitions