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EE1101: Circuits and Network Analysis

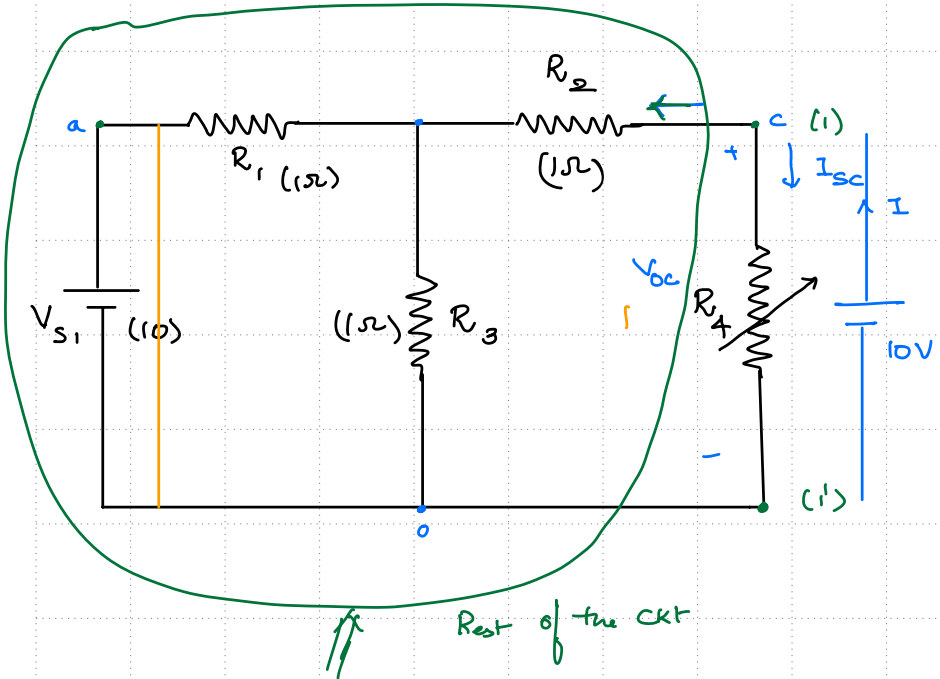
Lecture 10: DC Circuit Analysis

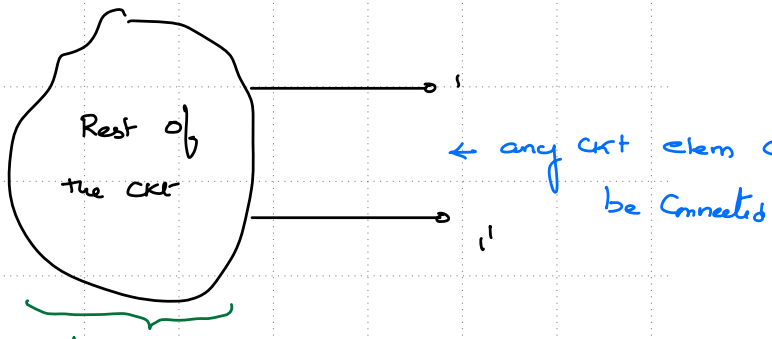
August 19, 2025

Topics :

1. Equivalent Circuits
2. Source Transformation

Using Port Parameters to find Circuit Response





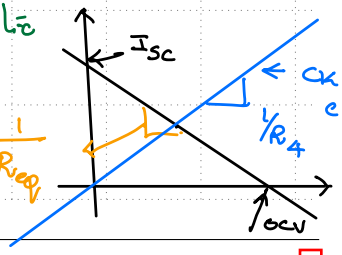
a) open ckt Voltage (OCV) → b/w 1-1'

b) Short ckt Current (SCC) → from 1 to 1'

c) Eq. Resistance (R_{eq}) → Current ref into node 1
Current ref out of node 1.
R_{eq} Seeing into Port
R_{eq} Seeing out of Port.

using

get the V-i characteristic



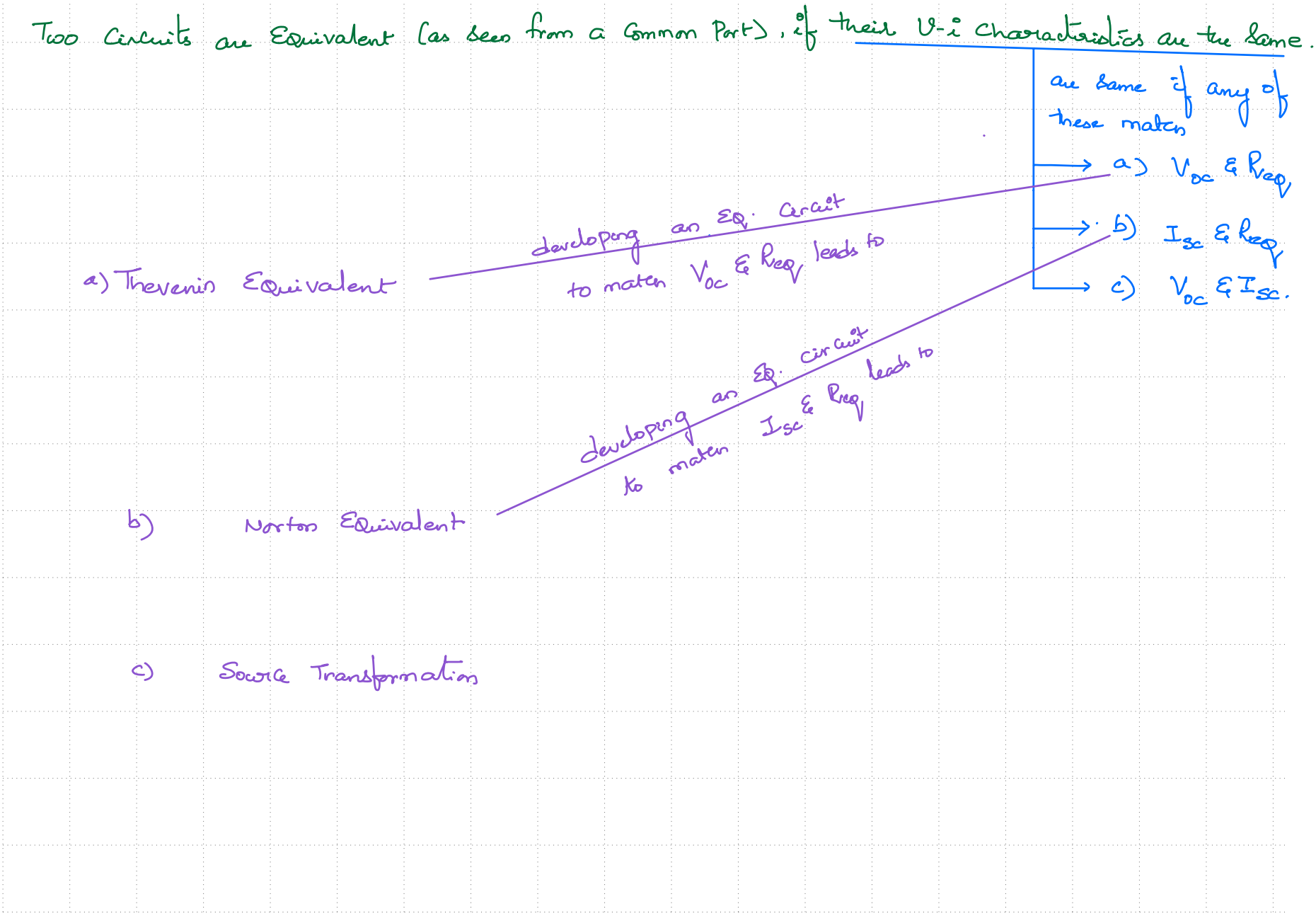
Open ckt Voltage = 5V

Short ckt Current = 10/3 A.

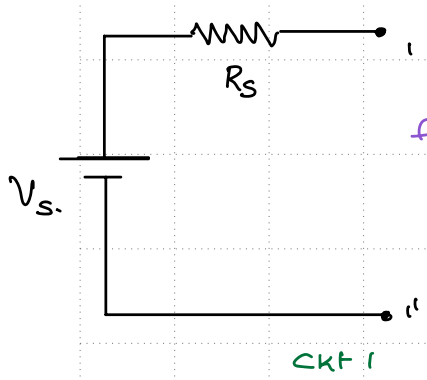
Eq. (input resistance) or as seeing into port } = 3/2 Ω.

Eq. (output) resistance or seeing out of the port = −3/2 Ω.

Using Port Parameters to find Circuit Response



Source Transformation

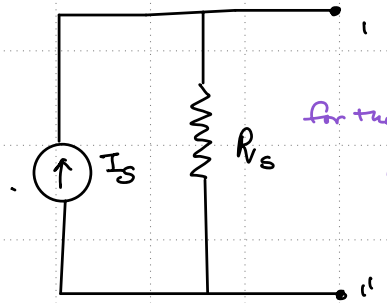


CKT 1

$V_{oc} = V_S$

for the part 1-1' $I_{sc} = \frac{V_S}{R_S}$

R_{eq} (out) $= -R_S$.



CKT 2

$V_{oc} = R_S I_S$

$I_{sc} = I_S$.

for the part 1-1'

R_{eq} (out) $= -R_S$

CKT (2) is Equivalent to CKT (1) if $I_S = \frac{V_S}{R_S}$

Voltage Source + Series Resistor can be replaced by a Current Source + Parallel Resistor

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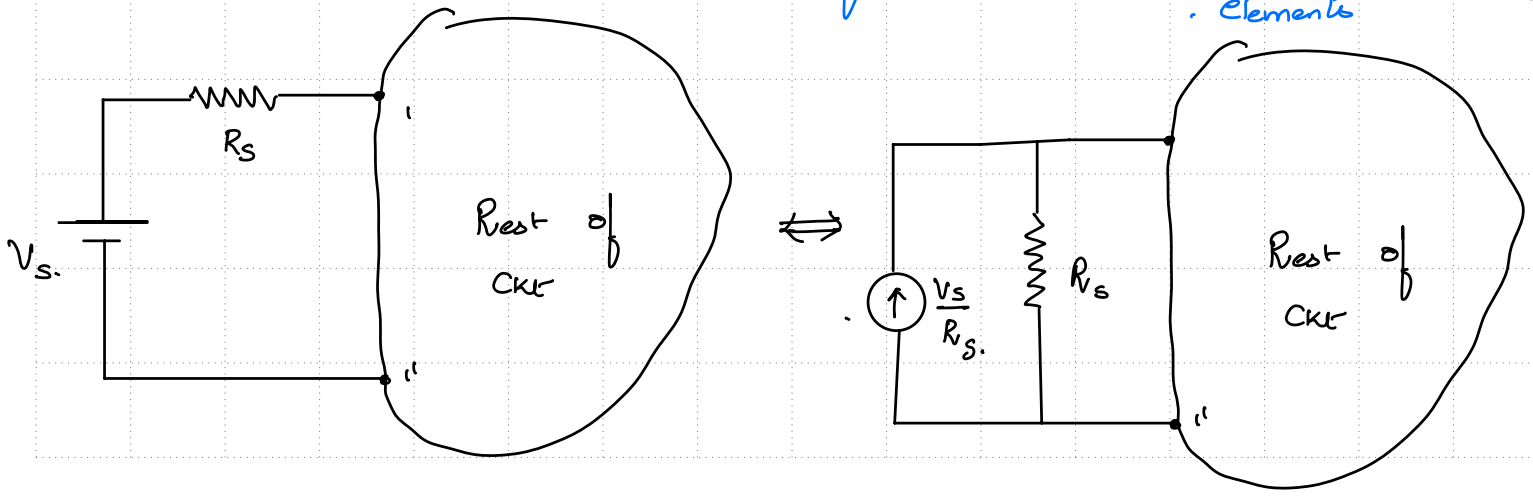
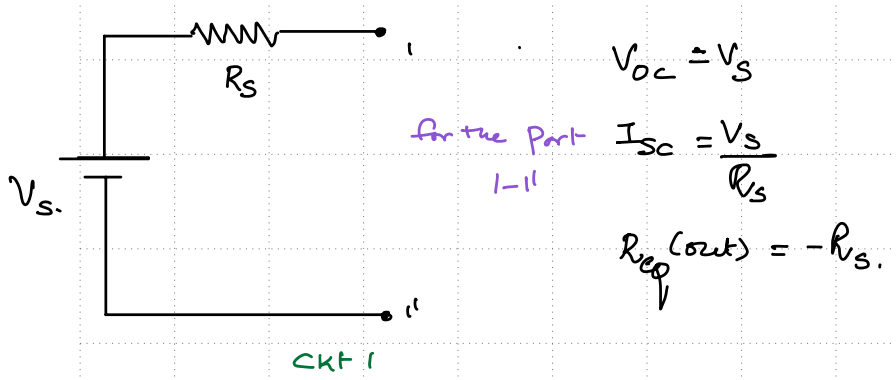
useful when the goal is to find the response in external elements

Mag of Current Source $= V_S/R_S$.



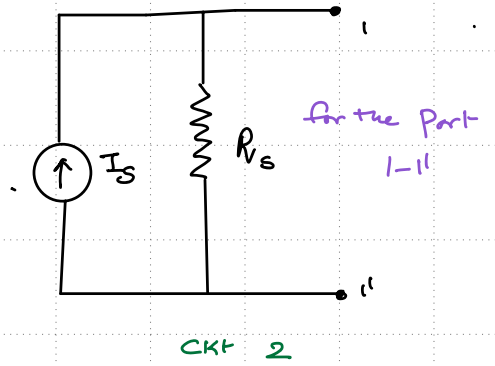
Source Transformation



$V_{oc} = V_s$

for the part 1-1' $I_{sc} = \frac{V_s}{R_s}$

$R_{eq}(\text{out}) = -R_s$.



$V_{oc} = R_s I_s$

$I_{sc} = I_s$.

for the part 1-1' $R_{eq}(\text{out}) = -R_s$

Ckt (1) is Equivalent to Ckt (2) if $V_s = I_s R_s$

Current Source + Parallel Resistor can be replaced by a Voltage Source + Series Resistor

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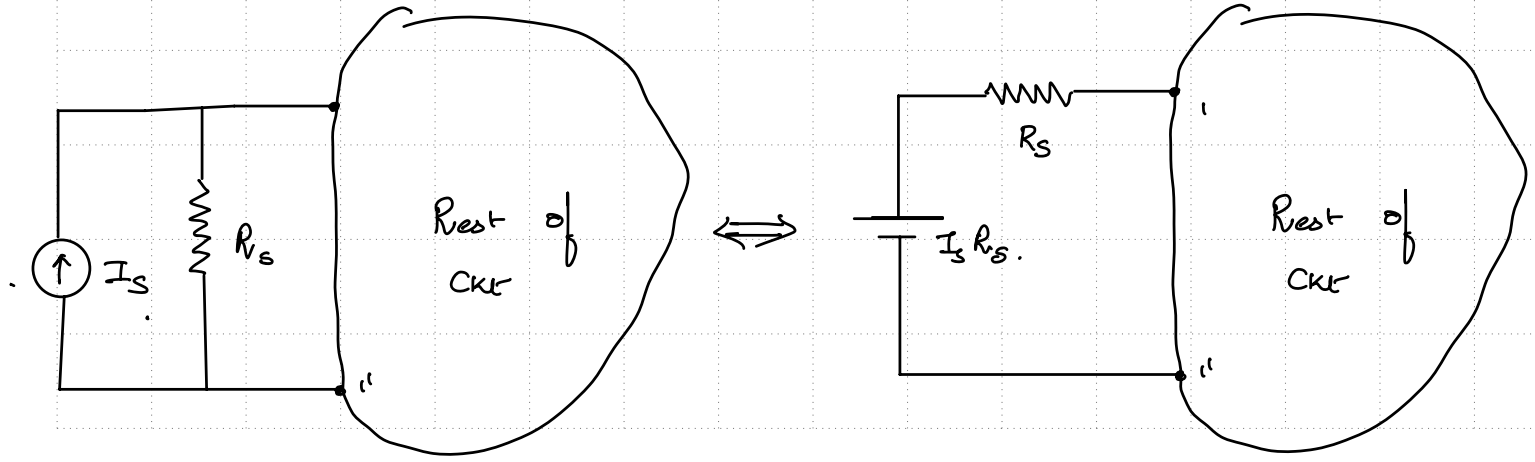
useful when the goal is to find the response in external elements

Mag of Voltage Source $= I_s R_s$



Equivalent Circuit