Structured Electronic Design

Exercises
The two-port and its chain matrix

\[
\begin{pmatrix}
    v_{in} \\
    i_{in}
\end{pmatrix}
= 
\begin{pmatrix}
    A & B \\
    C & D
\end{pmatrix}
\begin{pmatrix}
    v_{out} \\
    i_{out}
\end{pmatrix}
\]

\[
A = \frac{v_{in}}{v_{out}} \bigg|_{i_{out}=0} \\
B = \frac{v_{in}}{i_{out}} \bigg|_{v_{out}=0} \\
C = \frac{i_{in}}{v_{out}} \bigg|_{i_{out}=0} \\
D = \frac{i_{in}}{i_{out}} \bigg|_{v_{out}=0}
\]
Nullor

Input current and input voltage of the nullor are made zero via the output signals of the nullor

\[
\begin{pmatrix}
\v_i \\
i_i
\end{pmatrix} = \begin{pmatrix}
0 & 0 \\
0 & 0
\end{pmatrix}\begin{pmatrix}
v_o \\
i_o
\end{pmatrix}
\]
Inside the Nullor

Nullator

Norrator
Nullator? Norrator?

Nullator: 
- Current sensor
- Voltage sensor

Norrator: 
- Current source
- Voltage source
practical nullor implementations

A

B

C

D

ET8016 2008
Transistor implementations?
Choose

Nullor

Source

Load

A
B
C
D
"Expert" versus "logic"

![Diagrams of electronic circuits](image)

\[
L = \frac{1}{A_{CE}A_{CC}} \left( \frac{R_1}{R_1 + R_2} \right)
\]

\[
L = \frac{1}{2B_{CE}} \frac{1}{D_{CC}} R_1 \left( \frac{R_L}{1 + j\omega R_L C_L} \left( \frac{R_1 + R_2}{R_L + R_1 + R_2} + \frac{R_L}{1 + j\omega R_L C_L} \right) \right)
\]

- ☹ no miller effect
- ☑ less distortion
- ☹ distortion and clipping first stage
- ☑ Load dependent loopgain

- ☺ Loopgain not(less) load dependent
Direct transfer $A_{t0}$
Direct transfer $A_{t0}$
Exercises

Today:
• You work
• We walk around and help you when you are desperate

• Work on the exercises in the book, chapter 1
• Handouts exercises 1

• Take your time, there are still more exercise sessions to come

• When you have a result, check/discuss it with others, then you will find out if your answer is correct.
• The discussion will help the to understand the “WHY” part of the design.
• There will some solutions available at the end of this course
  (but probably you do not need them anymore at that time 😊)