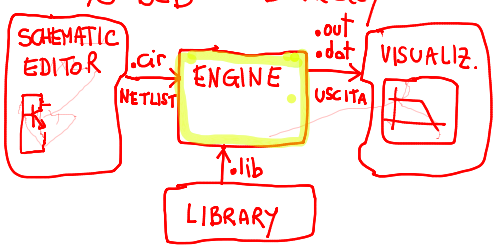
SPICE

Simulation Program with Integrated Circuit Emphasys

'70 UCB Berkeley



NETLIST

→ Prima riga vuota . TITOLO

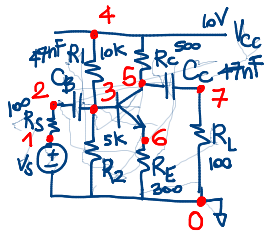
→ * ← commenti

→ COMANDI

→ CIRCUITO

→ MODELLI ←

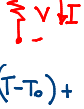
CIRCUITO



RS	2	1	100
R1	4	3	10K
R2	3	0	5K
RC	4	5	500
RE	6	0	300
RL	7	0	100
CB	3	2	47N
CC	5	7	47N
Vcc	4	0	DC 10
Vs	1	0	AC 1

Resistenza

Rxxxxxx n^+ n^- val <TC1=val <TC2=val>>



SUFFISSI	
K	10^3
MEG	10^6
G	10^9
T	10^{12}
M	10^{-3}
U	10^{-6}
N	10^{-9}
P	10^{-12}

$$R(T) = R(T_0)\left[1 + TC_1(T-T_0) + TC_2(T-T_0)^2\right]$$

$T_0 = 290K$

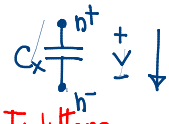
TC_1 coeff. di temp di ord 1

TC_2 coeff. di temp di ord 2

R1 3 0 100 TC1=0.01

Capacità

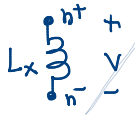
Cxxxxxx n^+ n^- val <IC = val>



Initial Conditions (V) (I)

Induttanza

Lxxxxxx n^+ n^- val <IC = val>



Generatori indipendenti

→ di Tensione

Vxxxxx n^+ n^- <DC val><AC val <phase>>

V1 1 0 AC 1 0

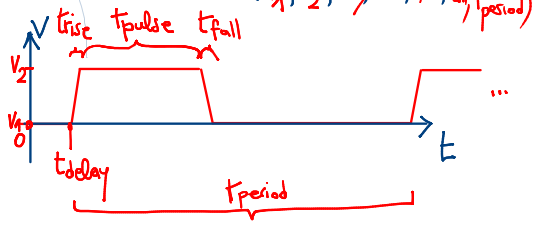
V2 2 0 AC 1 180

→ di Corrente

Ixxxxx n^+ n^- <DC val><AC val <phase>>

Generatori indipendenti x i transitori

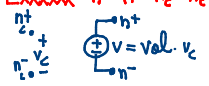
Vxxx n^+ n^- PULSE (v_1, v_2, t_{delay}, t_{rise}, t_{pulse}, t_{fall}, T_{period})



GENERATORI DIPENDENTI

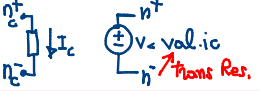
gen di tensione controllato da V

Exxxxxx n^+ n^- n_c^+ n_c^- val



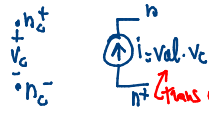
gen di V controllato da I

Hxxxxx n^+ n^- n_c^+ n_c^- Val



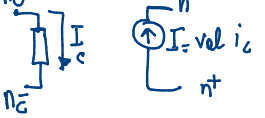
gen di I controllato da V

Gxxxx n^+ n^- n_c^+ n_c^- val



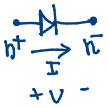
gen di I cont. da I

Fxxxxx n^+ n^- n_c^+ n_c^- val



Componenti a semiconduttore

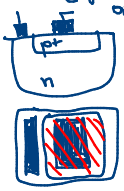
DIODI



Dxxxxx n^+ n^- nome_model <area>

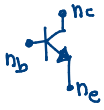
nome del modello

fattore di area



BJT

Qxxxxx n_c n_b n_e <n_s> nome_model <area>



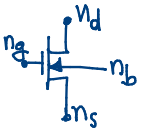
<IC= valbc, valbe>

tensione iniziale V_{BC}

tensione iniz. V_{BE}

MOSFET

Mxxxxx n_d n_g n_s n_b nome_model <L = vale >



<W= valw> <AD= valad>

<PD= val pd> <AS= val as>

<PS= val ps>

A = area
P = perimetro

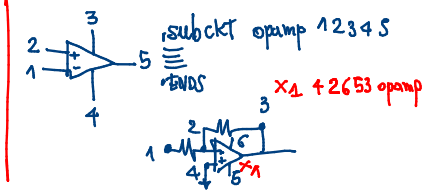
SOTTOCIRCUITI

Xxxxxx lista_dei_nodi_attuali nome_sc

definizione del sottocircuito

.SUBCKT nome_sc lista_dei_nodi_formali

.ENDS



COMANDI

.OP Operating Point → Punto Riposo

.DC Analisi in continua

.DC Vdd v_{in} v_{fi} v_{step}

valore iniz — valore fin — passo

.AC Analisi di piccolo segnale

.AC tipo_di_sudd n fin ffin

DEC OCT LIN

.AC DEC 10 1 1MEG

.AC LIN 100 10K 20K

.TRANS Analisi di grande segnale in funzione del tempo

.TRANS tstep tstop
↑ stima del passo temporale (max step)

.TRANS 2N 1M

MODELLI

.MODEL tipo nome_model <lista parametri>
↑ "tipo di disp" ↑ dipende dal tipo di disp

- npn
- pnp
- d
- nmos
- pmos
- njfet
- pjfet
- ⋮

Diodi [$I_S, \eta, R_S, C_j, C_T, \dots$] (17 per)

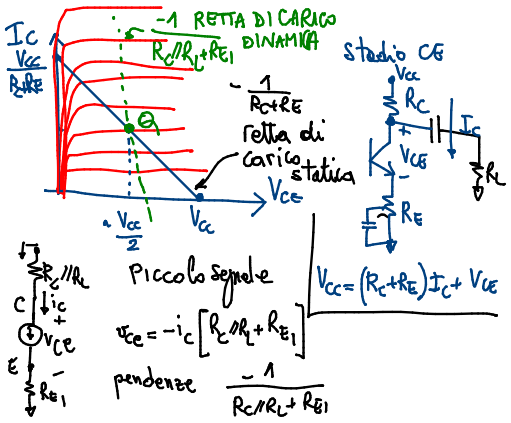
BJT [$I_{es}, I_{cs}, \alpha_F, \alpha_R, r_b, C_{be}, C_{bc}, \dots$] ∿ 40 par

MOSFET level 1 ⋮ level 17 BSIM4 ∿ 400 param

Es. 1 SPICE

Progettare un amplificatore video con amplificazione di tensione = 100 nella banda 10 Hz - 500 kHz. Si consideri un generatore di tensione con resistenza serie di 50 Ω e un carico di 500 Ω.

→ usare BJT 2n2222 ⇔
→ $V_{CC} = 12V$



Se la retta di carico statica ≅ alla retta di carico dinamica

allora $V_{CE} \cong V_{CC}/2$

Se la retta di carico dinamico è ben più ripida della retta di carico statica

allora $V_{CE} < V_{CC}/2$

[per es. $\frac{V_{CC}}{3}$, $\frac{V_{CC}}{4}$]