MISMATCH MODELLING FOR MOSFETS

1. PRINCIPLE

Mismatch models are requested in CMOS090 SPICE models. The <family>_dev parameter (svt_dev for SVT devices for instance) is used to define the simulation strategy. The pre-defined strategies are:

no mismatch: <family>_dev=0

mismatch using Monte-Carlo simulations: <family>_dev=1 + instance parameter mismatch= 1 + Monte-Carlo simulation (.mc in eldo)

So as to easily implement the simulation strategy into the netlists, the <family>-dev parameter has been included in a library file (mismatch.lib), within two libraries. The libraries are:

mismatch_no library: all <family>_dev parameters set to 0, no mismatch used

mismatch_param library: all <family>_dev parameters set to 1, mismatch through Monte-Carlo simulation

2. MODEL EQUATIONS

2.1 Standard deviation calculation

The standard deviation for Vt and mobility mismatch variations are calculated using the following equations:

$$\sigma_{VT} = \frac{A_{VT}}{\sqrt{2 \cdot mult \cdot W \cdot L}} + B_{VT} \text{ and } \sigma_\beta = \frac{A_\beta}{\sqrt{2 \cdot mult \cdot W \cdot L}} + B_\beta$$

where (A_{vt}, B_{vt}) and (A_β, B_β) are extracted on a pair of transistors by the Electrical Characterization team.

Then, using the above σ values, the total mismatch variations are applied as follows:

$$VT = VT_{w\backslash o\ mismatch} + \Delta_{VT} \text{ and } mobility = mobility_{w\backslash o\ mismatch} \cdot (1 + \Delta_\beta)$$

2.2 Mismatch through Monte-Carlo simulations

For Monte-Carlo simulations, the standard deviation values are used in order to define two gaussian distributions for VT and mobility mismatch variations.

These variations are then added to the pre-defined corner.

The mismatch Monte-Carlo simulations can be locally activated using the instance parameter "mismatch" (mismatch=1).

Moreover, it is also globally activated using the <family>_dev parameter (<family>_dev=1). The parameter <family>_dev can be defined in the netlist or via the mismatch.lib file.