

DICE INTRODUCES AI IN ANALOG SIMULATION

X150
FASTER
THAN SPICE

TRUE
SPICE
ACCURACY

WHAT IS DICE?



DICE IS
AN INNOVATIVE
ANALOG
SIMULATION
ENGINE.

- > AI and symbolic computation replace usual matrix solving.
- > DICE is designed to run on GPUs.
- > DICE answers the massive need of simulation in microelectronics.

WHY DICE?

DICE answers the massive need of simulation in microelectronics.

DICE answers the massive need of simulation in microelectronics. Simulation is key for the verification process, which is a mandatory step, and the only way to ensure performance and quality before production.

SIMULATION ALLOWS AVOIDING:

- > **Respins** (multi-million dollar production run)
- > **Poor yield** (impacts production costs)
- > **Overdesign** (impacts performance and costs)

Today, the simulation time is increasing, mainly due to:

- > **Increasing variations** with smaller process nodes
- > **Increasing analog content** in ICs
- > **Increasing number of simulation runs** to match quality objectives

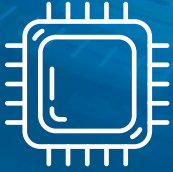
As a consequence, simulation can take up to several weeks. It is a bottleneck for electronic component manufacturers' growth.

Alternatives in this situation are to either delay the time to market, or introduce risks on product costs or quality. DICE provides a solution to this dilemma.



DICE OPERATES IN 2 STEPS

- 1 LEARNING:** DICE analyses the design, and finds the most efficient solving approach
- 2 COMPUTING:** DICE computes the simulation at high speed



DICE WILL RUN ON GPU'S

Once learning phase is completed, DICE will generate a code that can be massively parallelized by GPU's.

SPICE



Design



Simulation



Result

VS



Time

DICE



Design



Learning*



Simulation



Result

* Learning phase: performed only once per schematic, can be run in background.

TECHNOLOGY

DICE is a technology breakthrough in analog simulation.

Unlike SPICE, DICE does not use matrices to solve circuits. DICE uses an AI based learning engine that adapts to each design.

SPICE

$$\begin{bmatrix} \frac{1}{R1} & -\frac{1}{R1} & 0 \\ -\frac{1}{R1} & \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} & -\frac{1}{R3} \\ 0 & -\frac{1}{R3} & \frac{1}{R3} + \frac{1}{R4} \end{bmatrix} \begin{bmatrix} V1 \\ V2 \\ V3 \end{bmatrix} = \begin{bmatrix} I \\ 0 \\ 0 \end{bmatrix}$$

- > Matrix Solving
- > 1 solving methodology

DICE

$$V1 = I \left(R1 + \frac{R2(R3+R4)}{R2+R3+R4} \right)$$

$$V2 = V1 \left(\frac{R2(R3+R4)}{R2+R3+R4} \right)$$

- > Analytical Solving
- > AI defines methodology

PERFORMANCE

Today, without GPU parallelization implementation, DICE allows reaching

speedups above x150 compared to SPICE simulators with an equivalent accuracy.

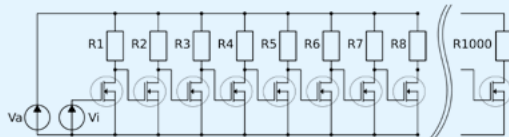
A 15 days simulation is reduced to 2,5 hours. Higher performances are expected when DICE will run on GPUs.

Use case:

1000 MOS cascaded with a constant voltage on the first gate.

Analysis:

Transient with fixed steps.



BENCHMARK

> Benchmark performed with one of **the top-3 EDA vendors SPICE simulator**.

SPEED

STEPS	SPICE Computing time (s)	DICE Computing time (s)	DICE Speedup
100	35	3	x 12,8
1 000	152	4	x 44,9
10 000	1 333	8	x 171,3
100 000	13 149	86	x 152,7
1 000 000	131 238	811	x 164,5
10 000 000	1 310 000*	7 965	x 164,5*

* Estimated

DICE Learning time: 245s

ACCURACY

- > SPICE and DICE provide **identical results with 4 digits**.
- > DICE systematically checks that all Kirchhoff laws are satisfied **with a 10⁻⁶ accuracy**.

CPU RESOURCES	SPICE	DICE
Threads	1	1

CONFIGURATION

> HARDWARE

CPU: i7-6700HQ @2.6GHz
Memory: 16GB

> SOFTWARE

OS: CentOS Linux release
7.6.1810
DICE version: 43b267

> MODELS

BSIM-CMG 110.0.0
Released 01/01/2016
Verilog-A

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