PSP simulation time

A.J. Scholten and D.B.M. Klaassen

CMC meeting, December 14th, 2006

test jobs and parameter sets

- three test jobs:
  - single-transistor DC bias sweeps
  - single-transistor TRAN sweeps
  - TRAN simulation of inverter with varying number of stages
- cpu time checked to scale linearly with
  # bias points (DC) or # time steps (TRAN)
- Linux
- model parameters PSP and BSIM4
  - models describe transistor geometry used equally well
  - both models without junctions
  - both models without GIDL
  - both models with gate current

test jobs and simulators

- we report cpu time
- jobs constructed for “large” cpu times, i.e. tens of seconds
- repeatability of cpu time checked
- single-transistor results checked to be equal for NMOS and PMOS
- test jobs have minimal output to minimize related time
- circuit simulators
  - ADS (Agilent)
  - HSIM (Synopsis)
  - ELDO (Mentor)
  - Spectre (Cadence)
  - TITAN (Infineon/Qimonda in-house simulator)

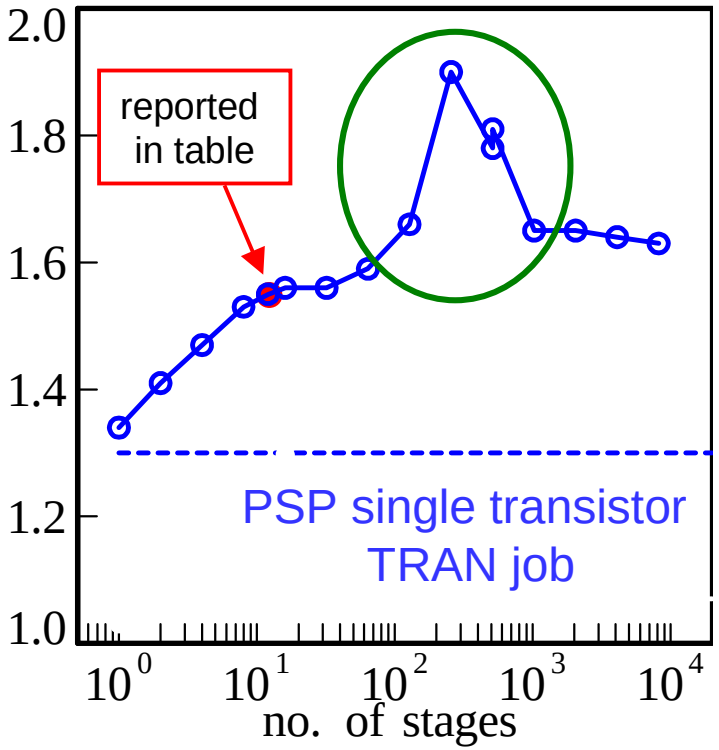
PSP/BSIM4 CPU time ratios

	DC single transistor	TRAN single transistor	TRAN 12-stage inverter chain	remarks
Spectre 6.1.0.151; *no SiMKit*	110%	130%	155%	PSP101 “built-in”
Spectre 6.1.0.151; SiMKit 2.4	120%	160%	222%	PSP102: available in SiMKit, uses CMI interface & SiMKit Spectre adapter
ADS2006A; SiMKit 2.4	139%	142%	192%	PSP102: MINT interface & ADS adapter
HSIM 2006.06-SP1-ENG3	97%	96%	96%	
ELDO	118%	112%	144%	J. Remy (STm) is acknowledged for providing these results
TITAN	139%	127%	124%	J. Assenmacher (Infineon) and W. Richter (Qimonda) are acknowledged for providing these results

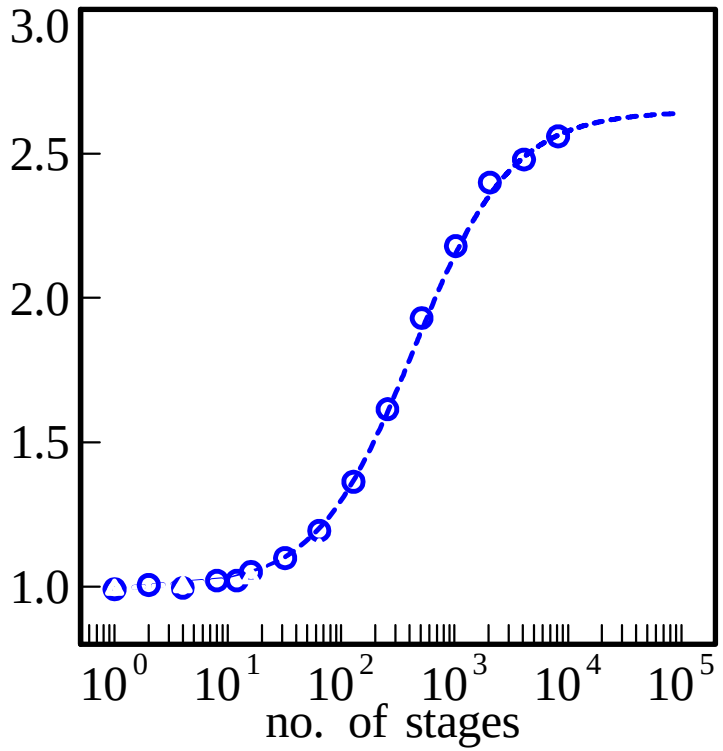
x-stage CMOS inverter: Spectre

Spectre 6.1.0.151: PSP101 “built-in”

CPU time
ratio vs BSIM4



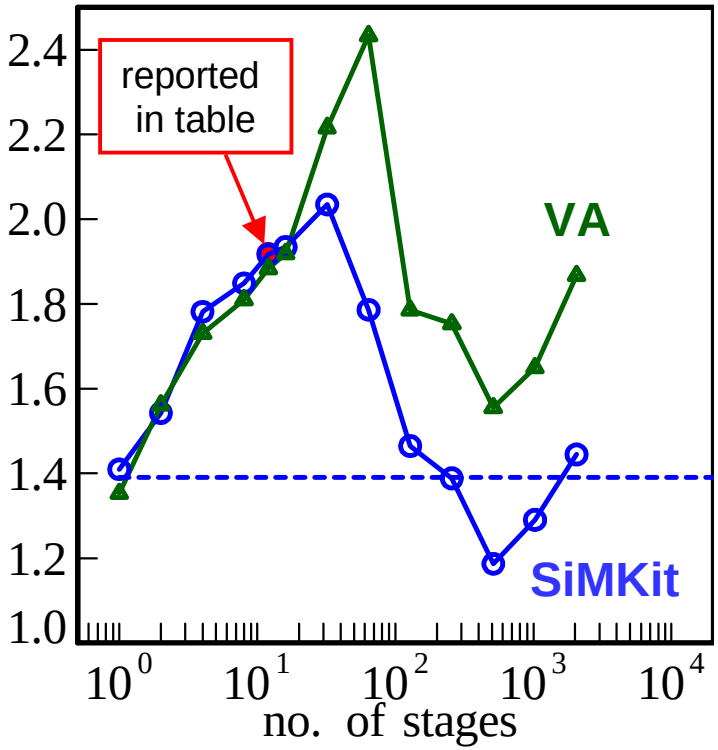
memory usage
ratio vs BSIM4



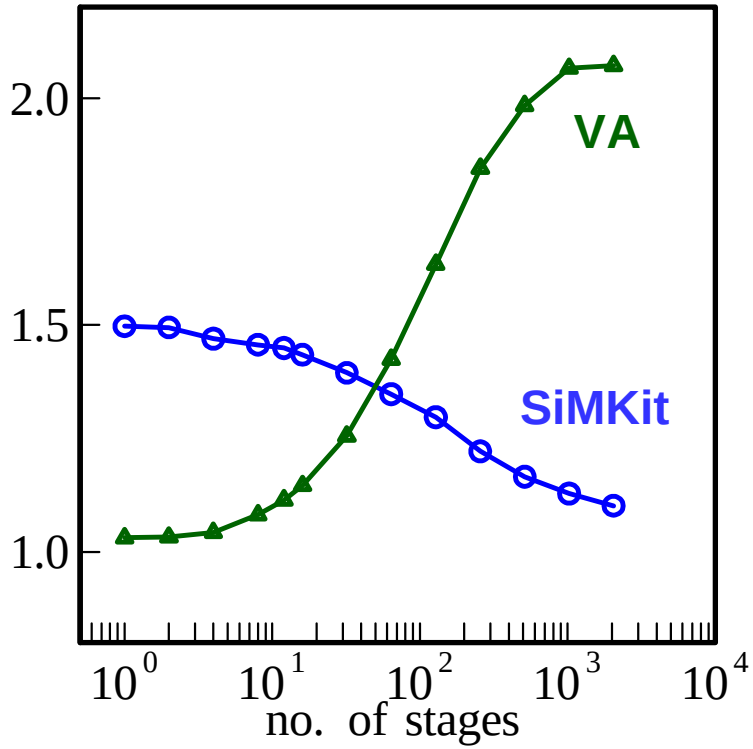
x-stage CMOS inverter: ADS

ADS; PSP102; SiMKit2.4 & VA

CPU time
ratio vs BSIM4



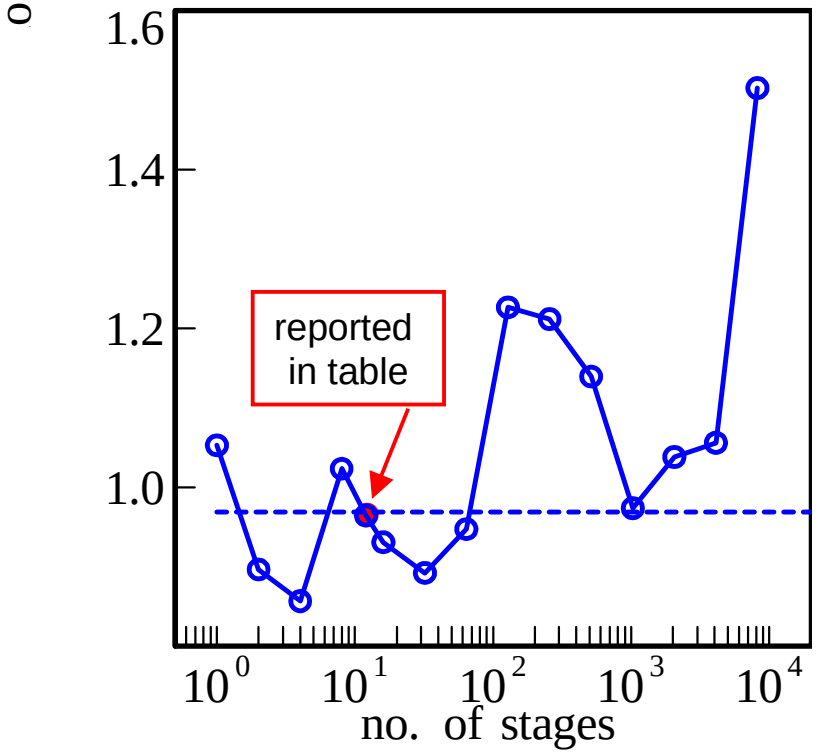
memory usage
ratio vs BSIM4



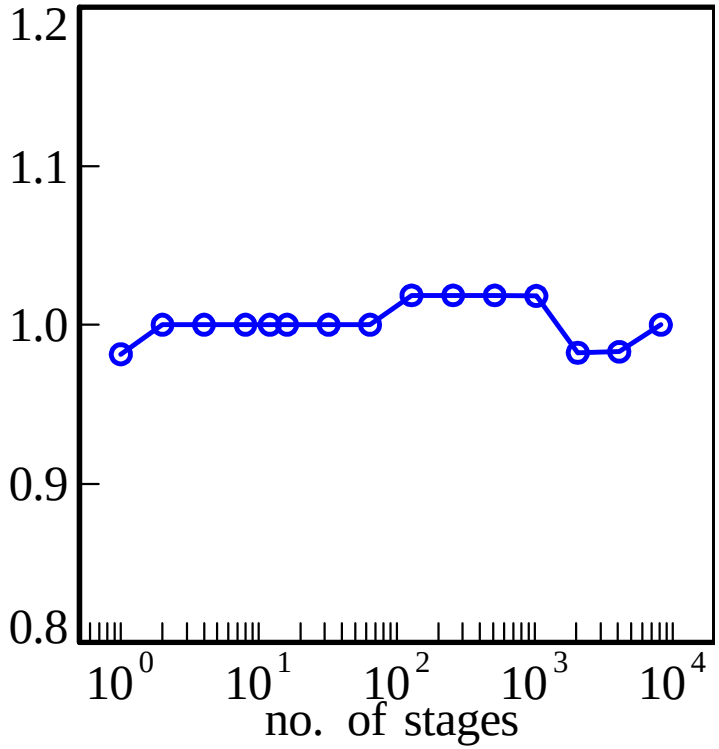
x-stage CMOS inverter: HSIM

HSIM; PSP102

CPU time
ratio vs BSIM4



memory usage
ratio vs BSIM4



summary

- different simulators show different results
- in ELDO, TITAN, HSIM,
  PSP/BSIM4 cpu time ratio between 1 and 1.4
- in ADS, results depend in a complicated way on the actual circuit and lie between 1.2 and 2.0
- in Spectre (no SiMKit) results depend in a complicated way on the actual circuit and lie between 1.3 and 1.9
- in Spectre with SiMKit, additional slow-down is observed
  – shouldn't be necessary
  – investigated at present
- cooperation with EDA vendors is needed