

Minutes of Compact Model Council Meeting

July 1, 2004 Face-to-Face Meeting in Durham, NC

Companies and Universities in Attendance:

IBM, STARC, NEC, Pennsylvania State University, Renesas, Freescale, ADI, TI, Silvaco, Hiroshima University, UMC, AMD, STM, Intel, Technical University of Crete, Federal University of Santa Catarina, Cadence, Broadcom, Intersil, Synopsys, Agere, Philips, Sandia National Laboratory, Mentor Graphics, TSMC, University of California at Berkeley, Nanyang Technological University, GEIA.

1. Membership Review (Joe Watts – IBM)

Samsung indicated to Joe they would like to join CMC. Joe is working out specifics.

2. Treasurer's Report (Robert Lomenick – Intersil)

Robert reviewed status of dues payments. He expects by end of July all 24 members will have paid their dues. This will provide sufficient funds for Mextram, HiCUM, BSIM3, BSIM4, and BSIMSOI model support. We may be about \$20K over at end of year.

3. Status of Standard Model Implementation

Synopsys, Cadence, and Mentor Graphics showed status and schedule of model versions. Cadence referred members to a website with this information: <http://www.designers-guide.com>. Silvaco reported they have all the latest model versions implemented and would provide a report at future meetings.

Cadence, Silvaco, and Mentor Graphics reported they support Verilog-a for compact models through an interpreter. Synopsys is developing this.

Action Item:

Synopsys, Mentor, and Silvaco will look into posting model version information on a website and report back to CMC.

4. BSIM3/4 Update

Jane Xi (UCB) reviewed UCB's research on several new effects.

Action Item:

Jane will implement the new gate length dependent mobility model in a test version of BSIM4; STM will test it and report back at the December CMC meeting.

Action Item:

Jane will look at improving the mathematical robustness of the thermal-assisted impact ionization current model being developed for BSIM4, based on Joe's feedback on its use in the BSIMSOI model. She will report back to the CMC.

Action Item:

Follow up on action item from March meeting to add Infineon's new Rgate equation, including instance parameters (NGCON, XGW, XGL): Jane will add these instance parameters to a BSIM4 test version and ask Infineon to test it. She will also follow up on the Rgate model with Infineon.

Peter Lee (Renesas) reported several BSIM4.4.0 bugs and requests for code improvements.

Action Item:

Jane will add parameter value checks for the MJ* parameters in a BSIM4 test version. The model will cause a simulator error if their values are outside the range $0 \leq MJ^* < 1$. Jane will figure out the most appropriate upper bound that is less than one.

Action Item:

Jane will correct several BSIM4.4.0 bugs reported by Peter Lee.

Action Item:

Jane will evaluate Peter Lee's suggestion for better default values for some gate current model parameters and report back to CMC.

Peter reported a Cgs model change between BSIM4.2.1 and BSIM4.3.0/BSIM4.4.0 caused by Vbseff model change. No change or fix was requested, since it appears to be insignificant.

Peter proposed implementing Vbs dependence in the Igc model.

Action Item:

Jane will use CMC member Igate data and BSIM4 models to investigate improving Vbs dependence of Igate. Interested members should send these to Jane. At a minimum, the 90nm data set from IBM for evaluation of the next generation MOSFET standard model candidates will be used.

Geoffrey Coram (ADI) proposed a fix to CAPMOD=3/2 for BSIM3/4.

Action Item:

Jane to make bug fix reported by Geoffrey Coram to CAPMOD=3/2 in BSIM3/4.

5. BSIMSOI Update

Joe gave an update on IBM's action items from the March meeting. These are works in progress.

Action Item:

Judy An (AMD) requested an additional instance parameter for BSIMSOI that is an adder to the VTH0. Jane will implement this as delvto, and report back in Sept. about possible BSIM4 implementation.

6. Resistor Model Update (Colin McAndrew – Freescale)

Colin reviewed progress of the resistor model standards team. He reported the two-terminal resistor model strategy changed in order to address critical requirements. There are three proposals for improved non-linear resistor modeling from ADI, Broadcom, and Agere. These will be provided to Colin who will distribute them to CMC members in Verilog-a for evaluation. A separate resistor model version with self-heating will also be distributed. The team also decided only two of the three instance parameters (R, L, W) will be allowed to be passed to the model; if three are passed it will cause a simulator error.

Team members also want a polysilicon resistor model, however no one is offering theirs up for standardization.

7. Power MOSFET Model Update (Keith Green – TI)

Keith review status of the power MOSFET model team. The team reviewed Philips' MOS Model 20: while it accounts for charge dynamics of the drain extension region it does not model quasi-saturation in the drain extension or self heating. Dick Klaassen reported Philips will add self heating, but has no plans for adding quasi-sat. However, Philips would consider this if they can be provided data.

Jane Xi quoted six months of dedicated UCB support per model to add self heating to BSIM3 and BSIM4. CMC decided not to do this due to other priorities.

Keith reported TI is continuing development of a quasi-sat model for the drain extension and may consider distributing it to CMC members for evaluation after it is completed.

8. Well Proximity effect (Pei Yao – Cadence)

Pei reviewed Cadence's work to model a well proximity effect and possible methodologies for incorporating it into BSIM4 and netlist-from-layout extraction tools.

Action Item:

CMC members will form a team to develop a recommendation for how to handle proximity / die location related effects. This will include documentation of pluses and

minuses of their recommendation. Companies on this team: IBM (Joe), Freescale (Surya), Cadence (Pei and layout extraction expert), ADI (Paul), Philips (Dick), Broadcom (Akira), Renesas (Peter), Synopsys (Michael), TI (Keith), and Mentor (Ahmed). Cadence representative and Paul will co-lead this.

9. Bipolar Support

CMC will support two BJT model standards HiCUM and Mextram.

Action Item:

Joe will follow up with Michael Schroter for clarification of the Verilog-a reference for HiCUM. There is concern that the noise model cannot be simulated through Verilog-a and simulators may give different Verilog-a results for the same reference code.

CMC agreed to pay for HiCUM and Mextram model support personnel to attend March '05 meeting.

HiCUM Update:

NTR

Mextram Update (Paul Humphries – ADI):

Paul reviewed status of Mextram 504. He also reported Delft has new websites for Mextram support and the September Mextram Users Group meeting.

Action Item:

Keith will change links on CMC website for Mextram to the new Delft support website.

Action Item:

Paul will ask Delft to send email to users notifying them of Mextram updates.

10. Verilog-a Update (Colin McAndrew)

Colin reported the proposed Verilog-a updates for compact model support were submitted to the AMS committee. Some issues are still being worked out with the committee, e.g., parmset definitions (model card v. instance) and mfactor.

11. Next Meeting planning (Joe Watts)

The next meeting will be held in Montreal on Thursday, September 16.

Meeting Adjourned.

This meeting was conducted in accordance with the EIA Legal Guides and EIA Manual of Organization and Procedure.