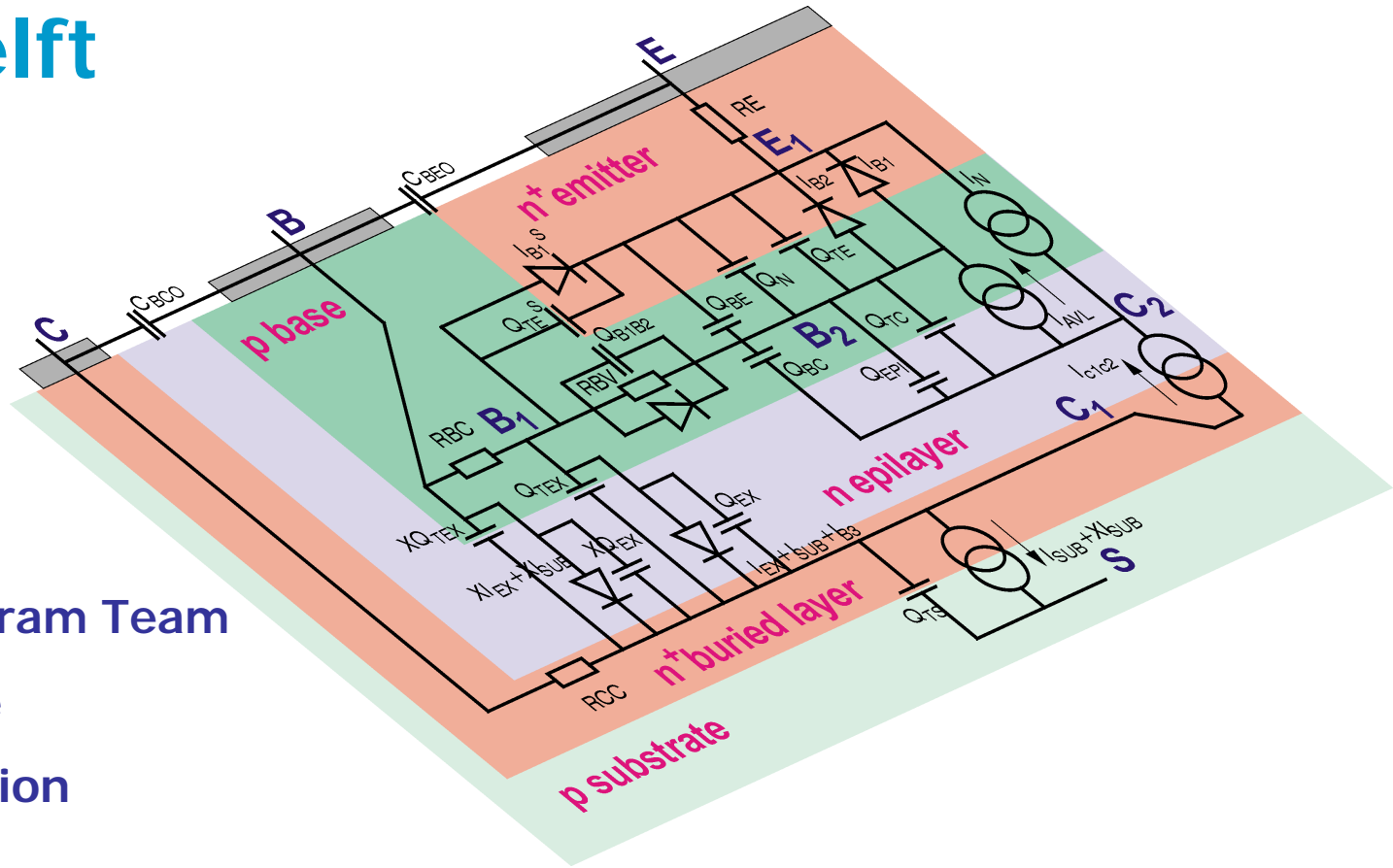


CMC Funded Mextram Support at TU Delft



Overview:

- TU Delft Mextram Team
- New Web Site
- Model Utilization
- Action Items

CMC Meeting, Montreal, September 16, 2004.

1

TU Delft Compact Modeling Group

Prof. Joachim Burghartz

Program Leader (HiTeC)

Slobodan Mijalkovic

Group Leader



Koen Buisman

Ph.D. Student

III-V HBT Modeling



Hsien-Chang Wu

Ph.D. Student

Geometry Scaling

Aliaksandra Kautaniuk

Web Site

Technical Support

Model Utilization



New Web Site

<http://hitec.ewi.tudelft.nl/mug/>

Repository for Mextram

- Documentation
- Implementation
 - SiMKit Code (libraries)
 - Verilog-A Code
- Logs on
 - Release announcement
 - Bug fixes
- Event Announcements

To update (introduce)

- Mailing List
- ? (Input from CMC)

MUG
The Mextram User Group

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Home

**Welcome to the world of
MEXTRAM User Group!**

The MEXTRAM User Group is created to centralize (established) the exchange of software, knowledge and ideas related to MEXTRAM bipolar transistor compact model. Our interests cover all aspects of MEXTRAM applications such as device characterization, parameter extraction, model development and implementation in EDA simulation tools.

As you travel through our site we hope you will take the time to look at all of the pages presented here, not just the ones you have come to see. You never know, you may make a pleasant "find" and broaden your knowledge just that little bit more.

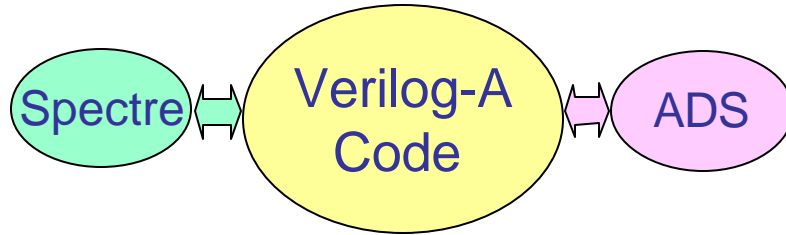
www MUG-site

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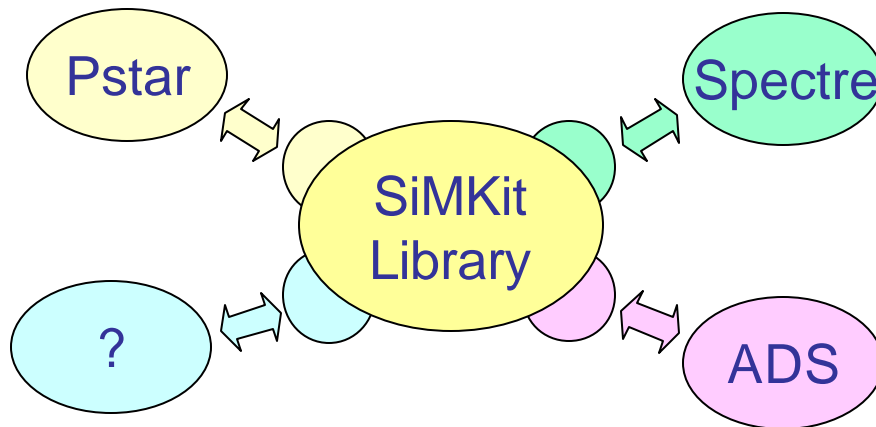
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CMC
HiTeC
DIMES

Model Utilization



- Verilog-A code mapping the latest Mextram release as described in the documentation.
- Experimental Verilog-A code for the evaluation of new modeling ideas.



- Source Code
 - Model implementation
 - Assembling interface
 - Very simple solver
- Compiled Libraries
 - Different platforms (HP, Sun, Linux)
 - Different simulators (Pstar, Spectre, ADS)

Mextram in SiMKit

Status

- **Mextram 504.3.0 in SiMKit 1.1.1 (Dec 2003)**
 - MULT has been moved into the list of parameters.
 - Added I_C , I_B and β_{DC} to operating point info
 - Bug: wrong implementation of CBEO, CBCO.
- **Mextram 504.3.1 in SiMKit 1.2.1 (Feb 2004)**
 - Correct implementation of CBEO, CBCO.
- **Mextram 504.4.0 in SiMKit 1.3 (May 2004)**
 - Model bug fix: noise in RCV has been removed.
 - Library for ADS (2003C or higher).
 - Simulation speed 10-20% faster due to the code improvements.

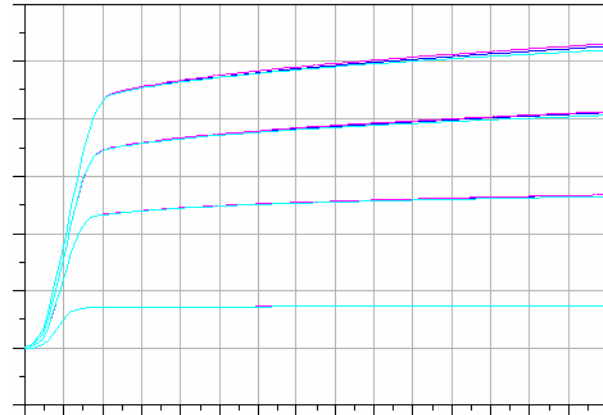
New Release

- **Mextram 504.5.0 in SiMKit 1.4 (Oct 2004)**
 - Bug for ISS=0 fixed (Analog Devices).
 - Temperature dependence of RTH.
 - New parameter ATH.
 - Published at BCTM 2004 in Montreal. (Paasschens, Philips Research)
 - Noise due to avalanche added Greenberg (MTT-S 2003)
 - New switch parameter KAVL.
 - Default = 0 : backward compatible
 - No extraction needed.
 - Published at BCTM2004. (Paasschens, Philips Research)

Mextram in Verilog-A

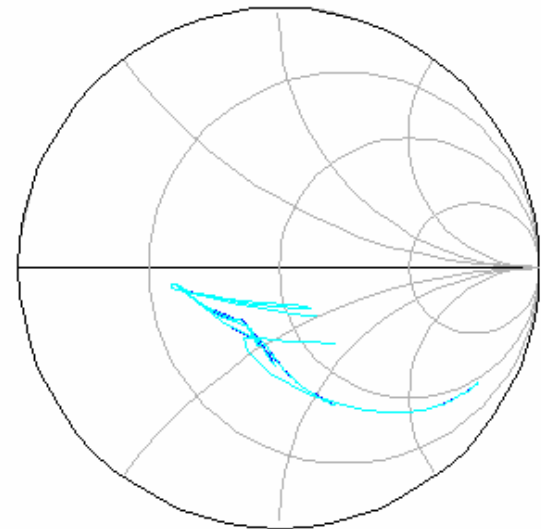
Status

- **Mextram 504.4.0 in Verilog-A**
 - Noise models are not implemented
 - Originally verified in Spectre
 - Simulation speed dramatically improved using Verilog-A compiler (ADS, ADMS).



New Release

- **Mextram 504.5.0 in Verilog-A (Oct 2004)**
 - Temperature dependence of RTH.
 - Adding noise models
 - Noise model of Mextram 504.4.0 +
 - Noise due to avalanche
 - Verified in ADS and Spectre



Action Items – Priority 1

- Release announcements with improved consistency.
- Bug fixes. Improve implementation time.
- Thick IFO flicker noise from UTA (TI/UTA will provide equations).
- Base-Emitter Zener breakdown (code in a published model).
- Add voltages to operating point variables (v_{be} , v_{ce} , v_{se} , v_{bc} , v_{bs})
- Optionally, let user specify XTI (like in Gummel-Poon) instead of existing (4-AB-AQBO) in the equation $I_S(T) = I_S * (T/T_{nom})^{(4-AB-AQBO)}$...

Action Items – Priority 2

- Without a buried layer, lateral voltage (IR) drops in the collector causes forward biasing of the internal collector base junction. This makes fitting DC and AC in quasi saturation very difficult.
 - Without a buried layer, collector resistance is a strong function of both V_{cb} and V_{cs} . Code in simple bias-independent splitting. Without a buried layer, collector resistance is a strong function of both V_{cb} and V_{cs} . Develop bias dependent physical model.
- Verilog-A Mextram 504.4.0 version.
- Enhance existing equations and code to improve the simulation speed.

Action Items – Priority 3

- CS leakage modeled rather than using ISS as flag (Code in an existing diode model)
- Substrate network: R_p , C_p , and R_s (Model parameters: R_p , C_p , and R_s . Instance parameters: R_p , C_p , and R_s override.)
- Time dependent impact ionization (Energy not field model. May try to set up an SRC contract for this.)
- Better Ge profile model (Equations developed for ramp profile. Need something more generic.)
- Tool to extract parameters from $N(x)$ (Productize completed MSEE thesis work)
- Auburn RF Noise when ready. (Will not be ready for 1-2 years.)
- Decrease in FT as function of V_{cb} as seen in GaAs.

Processing Model Modifications

- Make clear demonstration of a problem and the model insufficiency to handle it.
- Verification and testing of the proposed modeling equations, model simplifications or other proposed Mextram model modifications initiated by CMC will be performed by TU Delft (using experimental Verilog-A implementation).
- Approved modifications and reported bugs are implemented in the next SiMKit releases.