Standard Languages for Compact Modeling: Perspective of an Internal Model Developer

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Our Job: Active Device Models for Agilent

- InP HBTs
- GaAs HBTs
- GaAs PHEMTs
- GaAs E-PHEMTs
- GaAs MESFETs
- Diode Processes

$\mu_m$ TiPtAu gate
11 masking layers

GaAs S1 Substrate
$f = 24$ GHz
$4 \mu m$ TiPtAu gate
11 masking layers
Internal Technology vs. Commercial EDA Perspective

Worldwide Process & Technology Ctr.

• Device Physicists
• Semiconductor Process Engineers
• IC and MCM Designers
• Nonlinear Modeling Experts

• Develop advanced models for leading-edge technologies
• Develop technology at cost to enable business for Divisions

Agilent EEsof Division

• Software Engineers
• Simulator Experts
• Application and Support Eng.

• Implement and support standard models for large external customer base
• Sell EDA tools for Profit

WPTC needs rapid development and deployment of new models for internal-Agilent designers for proprietary advantage
Importance of Standard Language to WPTC

• Create new models for our new technologies
  • As simple as (interpreted) SDD; Verilog-A a natural language for modelers
  • More general interface to simulators for high value-added capabilities (behavioral models; neural networks)

• Compiled Verilog-A
  • Performance near that of expert-compiled C-code. (Still a claim to be verified)
  • Much less time-consuming and error-prone than compiled C-code (no Partial Derivatives required from modeler)
  • Protect our modeling IP; Easier to work with strategic partners
  • Distribute model to users of other simulators

• Enhance and maintain existing models
  • Not dependent on EDA vendor
AgilentHBT Model – SDD to C vs Compiled Verilog-A

DC-IV Characteristics

- 5000 lines of C-code
- 2 months of work
- 500 lines of Verilog-A
- 2 days of work

25 pages of Mathematica for Partial Derivatives!
Extensions Needed

• Better support for tables of data and interpolation
  • Table-based device models
  • Behavioral models

• Ability to link in new capabilities, such as Neural Networks
  • Enable us to add new capabilities to the standard simulators to support our modeling technologies