Certify- A Characterization and Validation Tool for Behavioral Models

Weifeng Li, Omair Abbasi, Naveed Hingora, Yongfeng Feng and Alan Mantooth
Mixed-Signal Computer Aided Design Lab (MSCAD)
Department of Electrical Engineering
University of Arkansas
Outline

- Introduction
- What is Certify
- Certify Details
- Examples on a Power Diode Model
  - DC transfer Analysis
  - Transient Analysis
- Conclusion
Introduction

- Writing a model which can accurately depict the characteristics of a real device is a challenging task.
- Writing a model solves just half of the problem. The other half is testing, characterizing and validating the model.
Why do we need Certify

- **Modeling needs**
  - Tools to facilitate model creation process
  - Tools to facilitate model characterization and validation process once the model is being developed
Why do we need Certify

- Model Characterization is a Time-Consuming process
  - Guess a value of the model parameters
  - Simulate the model
  - Compare the results with the target data
  - Change the value of model parameters if there is no match
  - Simulate and compare again

- Validating a model takes additional time
  - Multiple tests must be executed to test a model
  - Each test has to be run individually
Certify

- Certify is the tool to automate the process
- Uses ModLyng’s API to extract model data (parameters, default values, etc)
- Supports models written in MAST, and will expand to Verilog-A, Verilog-AMS and VHDL-AMS
- Is integrated with Saber simulator and partially integrated with VTB simulator
Model Characterization Methodology

- **Model Parameters**
- **Netlist**
- **Formulated Model Device Equations**

**Setup Experiments and Simulate**

- **Simulated Results**

**Match?**

- **NO**
  - **Model with New Parameter Values**

- **YES**
  - **Physical Experiment Setup**
  - **Physical Experiment Results**
Interaction with ModLyng and Saber
Architecture of Certify
Certify Details

- Certify is written in Python Language
- Certify GUI is developed using PyQt toolkit
- Certify Database uses XML format to represent all the information
Optimizer

- Get simulation commands from Elaborator
- Get model parameters and default values from ModLyng
- Interacts with Saber simulator through AIM language.
Certify GUI

- Test Bench Editor
- Experiment Editor
- Analysis Information
- Parameter Spreadsheet
- Optimizer
Certify GUI

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<tr>
<th>Parameter Names</th>
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Axis Range:

Load Default

Simulate | Optimize | Ok | Cancel
Examples: Power Diode Characterization

- Example 1: DC Transfer
Examples: Power Diode Characterization
Examples: Power Diode Characterization
Examples: Power Diode Characterization
Examples: Power Diode Characterization

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<th>Memory</th>
<th>Fixed Value</th>
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<th>Min Value</th>
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Examples: Power Diode Characterization
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- Extracted Parameters:
  - temp=75
  - isl=500a
  - area=1
  - isr=0
  - ish=undef
  - rs=0.33
  - bv=600
  - cjo=35p
  - tnom=25
  - xti=-10
  - xtih=0
  - alpha=0
  - trs1=-3.592377e-3
  - tsr2=-1.2367e-5
  - eg=1.6
  - mun=947
  - mup=180
  - gamma=2.92661
Examples: Power Diode Characterization

Example 2: Transient Analysis

```
(isr=0,lsl=5a,lsh=undef,lse=0,rs=.33,bv=600,cm=35p,vj=1.5,thn=25,eg=1.6,mm=947,mp=182)
```
Examples: Power Diode Characterization
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![Model Parameters GUI](image)

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<thead>
<tr>
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</table>
Examples: Power Diode Characterization
Examples: Power Diode Characterization

- **Extracted Parameters:**
  - temp = 125
  - isl = 1e-36
  - isr = 0
  - ish = undef
  - ise = 0
  - rs = 0.38
  - bv = 600
  - cjo = 35p
  - tnom = 25
  - eg = 1.6
  - mun = 947
  - mup = 182
Conclusion and Future Work

- Certify can create and store standard validation and characterization recipes which is reusable.
- The characterization process is automated and a lot of time can be saved.
- Certify uses ModLyng to extract model parameters and default values, and uses Saber simulator to simulate the model.
- Possible interaction with Matlab to implement optimization algorithm.
- Possible integration with other simulators such as Cadence Spectre.
Questions