IBIS-ISS: What It Is and What It Means to You

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Agenda

• The Problem of SPICE* Model Portability

• The Concept of IBIS-ISS

• What Is and Isn’t Supported

• IBIS-ISS and Good SPICE Usage

• Status and Future Work

• Summary and Call for Action!

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A Standard SPICE* Does Not Exist

• What does the following SPICE* statement do?
  \texttt{Bexample 1 2 I=\text{sin}(V(3,0))}

• Results depend on the SPICE tool you use
  – IBIS or non-linear dependent source?

• Some elements are not supported or do not share a common meaning in all SPICE variants
  – Other non-universal elements include P, W, Y, Z

How do you ensure a model works in your tool or your customers’ tools?
A Solution for SI/PI Interconnects

- SPICE* netlists include interconnects, devices and engine commands
  - e.g., .tran analysis for a driver and receiver on a PCB trace

- IBIS supports portable device models directly

- Engine commands are specific to EDA tools

- How to ensure interconnect models are portable?
  - Package, via, connector, PCB trace, on-die PDN...

IBIS-ISS: an industry baseline for interconnect modeling in SPICE

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IBIS-ISS in Simple Terms

• IBIS-ISS: IBIS Interconnect SPICE* Subcircuits

• Defines a limited set of common, basic elements useful for SI interconnect modeling

• Based on documents and concepts donated by Synopsys as seen in Synopsys HSPICE*

• Developed with SI community through IBIS Interconnect Task Group
  – EDA vendors, IC vendors and system vendors

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What Is (and Is Not) Supported

• Fundamental circuit elements
  – Resistors, Inductors, Capacitors: R, L, K, C
  – Dependent Sources: E, F, G, H
  – Transmission Lines: T, W (including tabular, Foster, etc.)
  – S-parameters: S

• Subcircuit definitions and instantiation
  – .subckt, .ends, X element

• Other basic commands
  – .include, .end, .param

... but no engine commands, no active device support, and no field solver

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Usage Model

• IBIS-ISS consists entirely of subcircuits and subcircuit definitions
  – IBIS-ISS does not define netlists
  – Subcircuits may be nested or independent

• All parameters are local, and passed explicitly

• Multiple files are supported (.include)

• Compliant tools simply accept IBIS-ISS files
  – Meaning, properly apply IBIS-ISS assumptions within the scope of the top-level subcircuit
How Does It Work?

```
.subckt my_trace_group 1 2 3 4 5 6 7 8 ref length=5e-3
* Units are meters
* This is a top-level subcircuit
* The user/system designer will instantiate this circuit in a netlist

Xtrace_a 1 ref 2 ref single_trace local_length=length
Xtrace_b 3 ref 4 ref single_trace local_length=length
Xtrace_c 5 ref 6 ref single_trace local_length=length
Xtrace_d 7 ref 8 ref single_trace local_length=length

* This circuit assumes no crosstalk
```

```
.subckt single_trace in local_ref out local_ref local_length=1

Wsingle in local_ref out local_ref N=1 L=`local_length`
+ TABLEMODEL=`single_line_table`

.include `single_line_table.inc`
* This file defines the tabular data using .MODEL
* This file should also be written using ISS rules
.ends
```

.ends
Using SPICE* Correctly

• Good SPICE* habits will make IBIS-ISS adoption and use easier
  – Pass parameters explicitly and sparingly
  – Do not rely on global parameter definitions
  – Avoid using global nodes
  – Use modular circuit design
  – Make node, parameter and element names clear and unique
  – Avoid setting engine options in subcircuits
  – Avoid ambiguous units and multipliers (e.g., amps vs. atto-)

Practice using IBIS-ISS rules in your circuits today
Status and Future Work

• Draft v0.7 now in review

• Once drafts are complete, the document will be provided to the IBIS Open Forum for approval

• A parser is under consideration

• Documents and background materials on-line:
  – http://www.eda.org/ibis/interconnect_wip/

• Mailing list available for updates and discussion:
  – http://www.freelists.org/list/ibis-interconn/

Questions and comments are welcome!
Summary

• If you model interconnects, IBIS-ISS can help ensure usability across SPICE* tools

• If you use SPICE of any kind, IBIS-ISS will be familiar to you

• Following principles of good SPICE circuit construction makes IBIS-ISS easy to use

Please study, learn, discuss and comment on the IBIS-ISS draft.
Your contributions are important!

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