Expanding IBIS for Power Simulations

Waymo: Zhiping Yang
Google: Aaron Xu, Hanfeng Wang
Missouri S&T: Chulsoon Hwang
Rivos: Songping Wu, Yansheng Wang
Intel: Kinger Cai, Chi-te Chen

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Objective

Expand the IBIS simulation capabilities on power integrity, power consumption, and SI/PI co-simulations

General rules

- Use the existing IBIS keywords as much as possible
- Focus on the coverage more than modeling accuracy
- The DC and power losses
- The AC impedance, from buck/booster converter to loading
- The transient, from buck/booster converter to loading

Passive elements

Here are a list of all possible passive elements:

- Resistor: mostly for current sensing.
- Capacitor: mostly for noise decoupling. It is covered relatively well with RLC and s-parameter models.
- Inductor: critical for switching power suppliers:
- Transformer and/or coupled inductor: less popular
- Connector (maybe this already available in IBIS)

Solution available
Focus of current power standardization
Future power standard expansion

Active direcrete elements

Here are a list of all possible active elements:

- Power Diode:
- Transistor: FET (voltage drive):
- Transistor: BJT (smaller power & high voltage) (current drive):
- Diode/transistor combination:

Solution available
Focus of current power standardization
Future power standard expansion

Integrated power solutions

Here are a list of all possible DC/DC converters:

- PMIC (Power Management IC) controller (not FET)
- DC/DC converter with integrated power stage
- LDO (Low Dropout Regulators)

Solution available
Focus of current power standardization
Future power standard expansion

Sinks/Loads

Examples:

- Core power supplies — Songping/Kinger/Chi-te
- I/O power supplies - AC/DC/Transient?

Solution available
Focus of current power standardization
Future power standard expansion

SPIM - Chip level Standard Power Integrity Model

.spim FILE

```
|-- File Header Section
|    -------------------
|    [IBIS Ver]     7.x
|    [Comment Chart] (ml)
|    [File name]
|    [File rev]
|    [Date]
|    [Source]
|    [Disclaimer]
|    [Copyright]
|
|-- [Begin Chip SPIM] component_name
|    ------------------------
|    [Manufacturer]
|    [Description]
|    |
|    [Begin SPIM] Power_signal_name (m)
|    |
|    [SPIM Pin Groups]   Power_signal_name    Gnd_signal_name
|    |Pin_group_name   Pin_name
|    |  -----------
|    |    |-- [End SPIM Pin Groups]
|    |
|    [SPIM Port List]
|    |Port    Terminal_p          Terminal_n          |Port_function(optional)
|    | #       OB_Stimulus_#_p   OB_Stimulus_#_n    |OB_Stimulus_#
|    | #       OB_Sense_#_p      OB_Sense_#_n       |OB_Sense_#
|    |  -----------
|    |    |-- [End SPIM Port List]
|    |
|    |
|    |
|    [SPIM Touchstone File Name]
|    |  -----------
|    |
|    [SPIM Stimulus]
|    |OB_Stimulus   Weighting
|    |  -----------
|    |    |-- [End SPIM Stimulus]
|    |
|    [SPIM Target]
|    [SPIM Observation Port]
|    |Frequency      Z(typ)      Z(min)        Z(max)
|    |  -----------
|    |    |-- [End SPIM Target]
|    |
|    [SPIM Rnetwork File Name]
|    |  -----------
|    |
|    [SPIM Current]
|    |I(name)      I( type)     I(min)     I(max)
|    |  -----------
|    |    |-- [End SPIM Current]
|    |
|    [Voltage List]
|    | V(name)    V(typ)      V(min)      V(max)
|    |  -----------
|    |    |-- [End Voltage List]
|    |
|    [End SPIM] Power_singal_name
|    |
|    [End Chip SPIM] component_name
|    |
|    [End]
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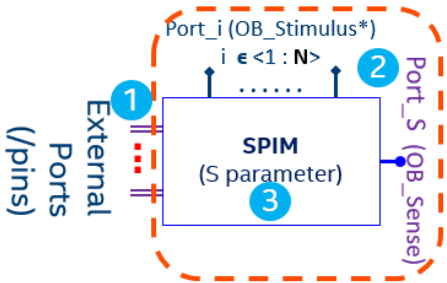
Tree Structure of .spim FILE



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Input/output power interfaces

Examples:

- Wired USB-C interface
- Simple charging port
- Wireless charging

Battery pack

- To be determined

Conclusion

- Proposal to add new components into IBIS to implement the end-to-end power integrity simulations from die to regulator
- People who are interested are welcome to join the discussion and contribute their ideas