



## IBIS Open Forum Minutes

Meeting Date: **November 14, 2016**

Meeting Location: **Taipei, Taiwan**

### VOTING MEMBERS AND 2016 PARTICIPANTS

ANSYS	Curtis Clark, Toru Watanabe
Broadcom (Avago Technologies)	Bob Miller
Cadence Design Systems	Ken Willis, Brad Brim, Aileen Chen, Lanbing Chen Zhiyu Guo, Mohan Jiang, Rachel Li, Ping Liu Haisan Wang, Yitong Wen, Clark Wu, Dingru Xiao Benny Yan, Haidong Zhang, Wenjian Zhang Zhangmin Zhong, Hui Wang, Jinsong Hu, Wei Dai Rong Zhang, Kent Ho*, Skipper Liang*, Jack Lin* Candy Yu*
Cisco Systems	Giuseppi Selli, Brian Baek, Hannah Bian, Tonghao Ding Amanda Liao, Cassie Yan
CST	Stefan Paret
Ericsson	Anders Ekholm*, David Zhang, Zilwan Mahmud Guohua Wang
GLOBALFOUNDRIES	Steve Parker
Huawei Technologies	Yuanbin Cai, Haiping Cao, Zhenxing Hu, Peng Huang Xusheng Liu, Longfang Lv, Guanjiang Wang Chen Yu, Cheng Zhang, Gezi Zhang, Zhengyi Zhu Fangxu Yang, Huajun Chen, Xiao Peng Zhengrong Xu, Xianbiao Wang, Lin Shi Hongcheng Yin
IBM	Adge Hawes, Luis Armenta, Trevor Timpane
Infineon Technologies AG	(Christian Sporrer)
Intel Corporation	Hsinho Wu, Mohammad Bapi, Michael Mirmak, Masahi Shimanouchi, Todd Bermensolo, Zao Liu, Gong Ouyang, Udy Shrivastava, Gianni Signorini, Richard Mellitz, Youqing Chen, Jennifer Liu Luping Liu, Bruce Qin, Yuyang Wang, Denis Chen* Jimmy Hsu*, Thonas Su*, Morgan Tseng*
IO Methodology	Lance Wang*
Keysight Technologies	Radek Biernacki, Heidi Barnes, Jian Yang, Fangyi Rao, Stephen Slater, Pegah Alavi, Edwin Young
Maxim Integrated	Yan Liang, Don Greer, Thinh Nguyen, Joe Engert, Hock Seon, Ahmed Gendy
Mentor Graphics	Arpad Muranyi, Vladimir Dmitriev-Zdorov, John Angulo, Mikael Stahlberg
Micron Technology	Randy Wolff, Justin Butterfield

Signal Integrity Software	Mike LaBonte*, Walter Katz, Todd Westerhoff, Richard Allred
Synopsys	Ted Mido, Kevin Li, Massimo Prando, Xuefeng Chen Andy Tai, Jinghua Huang
Teraspeed Labs	Bob Ross
Xilinx	(Raymond Anderson)
ZTE Corporation	Shunlin Zhu, Fengling Gao, Lili Wei, Zhongmin Wei Bi Yi, Changgang Yin, Yang Yang, Xiaoli Yu
Zuken	Michael Schaefer, Amir Wallrabenstein

### **OTHER PARTICIPANTS IN 2016**

AAT	Sam Liu*
Alcatel-Lucent	Yishan Li, Yiqing Mao
ASUSTek Computer	Nick Huang*
Aurora System	Dian Yang
Avant Technology	Jyam Huang*, Chloe Yang*
BasiCAE Software Technology	Darcy Liu
Celestica	Allen Wang, Vincent Wen
eASIC	David Banas
Edadoc	Deheng Chen, Hong Zhang
FiberHome Technologies	Yeijing Jia
Foxconn Electronics	Gino Chen*, Ryan Hou*, Mandy HY Su*
Fujitsu Advanced Technologies	Shogo Fujimori
Ghent University	Paolo Manfredi
Gigabyte Technology	Chris Tsai*, CJ Wang*
Gowin Semiconductor	Xiaozhi Lin, Qi Zhou
H3C	Bin Chen, Mao Jun, Xing Hu
Hamburg University of Technology	Jan Preibisch, David Dahl
Hanghou Hikvision Digital Technology	Wenquan Hu
Hewlett Packard Enterprise	Passor Ho*, Corey Huang*, Hellen Lo*
Hisilicon	Wei Zhen,
Independent	Carl Gabrielson
Info TM Microelectronics	Aofeng Qian
Institut Supérieur des Sciences Appliquées et de Technologie de Sousse	Wael Dghais
Inventec	Zhong Peng
JEITA	Yosuke Kanamaru
John Baprawski, Inc.	John Baprawski
KEI Systems	Shinichi Maeda
Lattice Semiconductor	Dinh Tran, Maryam Shahbazi
Leading Edge	Pietro Vergine
Lenovo	John Lin*, Alan Sun*
Lite-On Technology	Steven Chen*, Steven CH Chen*, Sam Lyu*

Marvell	Jie Pan, Weizhe Li, Liang Wu, BL Qian, Fang Lv
MathWorks	Mike Mulligan, Corey Mathis
Monsoon Solutions	Nathan Hirsch
Mostec	Ninghua Li, Kaihe Zhang
Nanya Technology Corp.	Chiwei Chen*, Andy Chih*, Taco Hsieh*, Jordan Hsu* Andre Huang*, Raphael Huang*, George Lee*, Allen Zuo*
Northrup Grumman	Alex Golian
Novatek	Vincent Lin*, Willy Lin*
Nvidia Corp.	Norman Chang*, David Chen*, Chihwei Tsai*, Ann Yen*
NXP	Jon Burnett
Peace Giant Corp.	Walter Huang*, Jimmy Liu*
Pegatron Corp.	Aje Chang*, Stanley Chu*
Politecnico di Torino	Claudio Siviero, Stefano Grivet-Talocia, Igor Simone Stievano
Qualcomm Technologies	Guobing Han, Irwin Xue*
Quanta Computer	Eriksson Chuang*, Scott CH Lee*
Rambus	John Yan
Raytheon	Joseph Aday
SAE International	(Logen Johnson)
SAIC Motor Corp	Weng Yang
Shanghai Zhaoxin Semiconductor	Jude Ji
Shenzhen Zhongzeling Electronics	Nick Huang
SILABTECH	Biman Chattopadhyary
Silicon Motion Technology	Matt Lin*
Signal Metrics	Ron Olisar
SiGuys	Donald Telian
SMICS	Sheral Qi
Sony Corporation	Hiroaki Ammo
Sony LSI Design	Takashi Hasegawa
SPISim	Wei-hsing Huang*
Spreadtrum Communications	Junyong Deng, Steven Guo, Baoping Bian Yanbiao Chu, Nikki Xie, Zhi Wang
STMicroelectronics	Fabio Brina, Olivier Bayet
Technoprobe	Alberto Berizzi, Lorenzo Bernasconi, Simona Cucchi
Teledyne LeCroy	Denny Li, Yifeng Wu
Université de Bretagne Occidentale	Mihai Telescu
Vendorchain	Jun Zhao, Jing Luo, Dong Lei
VIA Labs	Sheng-yuan Lee*
VIA Technologies	Terence Hsieh*, Jerry Hsu*, Justin Hsu*
Winbond Electronics	Albert Li*
Xpedic Technology	Max Cang*, Mingcan Zhao, Zhouxiang Su, Rui Wang Qionhui Gui, Wenliang Dai, Yuqing Shen Haitao Zhang, Rick Chang*, Zachary Su*
Zhejiang Uniview Technologies	Wei qi Chen, Jiayun Dai

In the list above, attendees at the meeting are indicated by \*. Principal members or other active members who have not attended are in parentheses. Participants who no longer are in the organization are in square brackets.

## UPCOMING MEETINGS

The bridge numbers for future IBIS teleconferences are as follows:

Date	Meeting Number	Meeting Password
November 18, 2016	Asian IBIS Summit Tokyo – no teleconference	
December 2, 2016	628 078 024	IBISfriday11

For teleconference dial-in information, use the password at the following website:

<https://sae.webex.com/sae/j.php?MTID=m0a07ee0ddc25e28af96b4bbad3c17f4b>

All teleconference meetings are 8:00 a.m. to 9:55 a.m. US Pacific Time. Meeting agendas are typically distributed seven days before each Open Forum. Minutes are typically distributed within seven days of the corresponding meeting.

NOTE: "AR" = Action Required.

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## OFFICIAL OPENING

The Asian IBIS Summit took place on Monday, November 14, 2016 at the Sherwood Hotel in Taipei. About 59 people representing 26 organizations attended.

The notes below capture some of the content and discussions. The meeting presentations and other documents are available at:

<http://www.ibis.org/summits/nov16b/>

Mike LaBonte welcomed participants on behalf of the IBIS Open Forum and convened the meeting, noting that only technical presentations would be on the agenda, and there would be no voting.

Mike continued by thanking all the co-sponsors including Cadence Design Systems, IO Methodology, Peace Giant Corporation, Synopsys and Xpedic Technology.

## IBIS CHAIR'S REPORT

Mike LaBonte (Signal Integrity Software (SiSoft), USA)

Mike LaBonte presented updates on work in progress in the ATM, Interconnect and Quality task groups. This includes an IBIS 6.2 release, backchannel support, C\_comp model enhancements, redriver flow enhancements, and an interconnect modeling BIRD. Several BIRDS have been approved for IBIS 6.2 while some are still in progress. The IBIS Open Forum

has 22 members and regular teleconference and Summit meetings. The China regional forum is a new group affiliated with IBIS.

### **CASE STUDY: MODELING IBIS FOR OPEN\_DRAIN TRUE DIFFERENTIAL PAIR BUFFER**

Lance Wang\*, Yan Liang\*\* (\*IO Methodology and \*\*Maxim Integrated, USA)

Lance Wang presented. An Open\_drain differential pair presents a special case for IBIS modeling. The Open\_drain model type does not use Pullup I-V data, but this data is useful for modeling this type of buffer. Using an Output or I/O model type to model this type of buffer allows inclusion of Pullup I-V data and is a better solution. Improvements to the C\_comp model to capture voltage and frequency dependencies would improve the model further.

### **DIFFERENTIAL MODELING FLOW WITH SERIES MODEL IN VERILOG-A**

Wei-hsing Huang\* and Sanjeev Gupta\*\* (\*SPISim, USA and \*\*Sigintegrity Solutions, India)

Wei-hsing Huang presented. Half/true differential buffers are modeled including a series model for the effects of differential current and differential capacitance. The rigid syntax of the series model can lead to many inaccuracies. Replacing the series model with a Verilog-A model using [External Model] syntax streamlines the modeling flow, improves V-T extraction accuracies, and removes the rigid series model syntax. A modeling flow for creating the Verilog-A model was presented.

### **IBIS-AMI MODEL GENERATION WITH QUALITY**

Skipper Liang (Cadence Design Systems, ROC)

Skipper Liang presented starting with an overview of channel simulation equations and IBIS-AMI models. IBIS-AMI model generation flow involves many steps, and validation is the key. Validation includes comparisons to Spice transistor-level model simulations. An example was shown of USB 3.0 RX and TX IBIS-AMI models in simulation including real channel characteristics.

A comment was made that the IBIS-AMI model validation should check the modified impulse/step response, not waveforms and eye diagrams.

### **ACHIEVING FULL SYSTEM SIGNAL INTEGRITY FOR HIGH SPEED BACKPLANE SYSTEM**

Wenliang Dai (Xpeedic Technology, PRC)

Zachary Su presented. The presentation included an introduction of backplane systems, challenges to backplane system simulation, components of EM simulation, an analysis workflow, and details of full backplane system SI simulation. Zachary concluded that passive channel modeling and simulation is essential to high speed channel design. Optimal channel design requires user friendly EDA tools to do layout extraction, via optimization, trace simulation, S-parameter cascading and S-parameter exploration. Full backplane system SI simulation is achieved by sweeping all the channels with correct models.

## **ON-DIE DECOUPLING MODEL IMPROVEMENTS FOR IBIS POWER AWARE MODELS**

Randy Wolff# and Aniello Viscardi## (Micron Technology, #USA, ##Italy)

Lance Wang presented. He noted that on-die decoupling models for power aware modeling must be added external to the IBIS model currently. To correlate an IBIS model simulation with a transistor model simulation, the decoupling model may need multiple terminals. A Spice model may include a pre-driver on a separate power supply from the driver, and coupling may exist between the pre-driver supply and the final driver supply. The pre-driver and final driver may also share a common ground. One method for creating a non-proprietary decoupling model involves creating an S-parameter model. The S-parameter model could have multiple port options and may require a node 0 reference. Lance showed results of two simulations including package models with either an ideal or non-ideal connection to the pre-driver supply of the Spice model. A 2-port decoupling model was necessary for good correlation in the case with the ideal connection to the pre-driver supply. A 3-port decoupling model was necessary for good correlation in the case with the non-ideal connection to the pre-driver supply. Lance concluded that a multi-port decoupling model is most versatile. Unused ports not connected to a package model should be connected to node 0, which is also the reference port for the S-parameter model.

A question was asked if the decoupling network should be captured in the I-T and ISSO data in the model. Lance answered that the decoupling network is around the power supply and/or between the pre-driver and driver. It is not captured in I-T and ISSO curves.

## **IBISCHK6 V6.1.3 AND EXECUTABLE MODEL FILE CHECKING**

Bob Ross (Teraspeed Labs, USA)

Mike LaBonte presented. New ibischk6 version 6.1.3 executables are available that BUGs 174-180. The executable names include 32 and 64-bit operating system designations. An enhancement is executable model file checking per BUG179 for [Algorithmic Model] executable lines. Executable files are checked for the existence of required functions based on .ami file Reserved\_Parameters settings.

## **TOUCHSTONE CONVERSION WRAPPER**

Anders Ekholm (Ericsson, Sweden)

Anders Ekholm presented. The tschk2 Touchstone file parser can be used to convert Touchstone models to Touchstone 2 models using the `-canonical` option. Using this option strips out any comments from the original Touchstone file which may contain useful port information. Anders wrote a Perl script that solves this issue. The script is available on the IBIS Open Forum website.

A question was asked about the difference between Touchstone 1 and Touchstone 2. Anders answered that Touchstone 2 contains more enhancements. For example, it can use different reference impedances for each port.

## DISCUSSION

Mike LaBonte surveyed the attendees and established that most attendees were IBIS users. One attendee suggested that it would be helpful to have a workshop on how to find problems in IBIS models and fix them where possible. Mike mentioned that sometimes the simplest of problems such as having a wrong [File Name] could make a model fail, yet that is very easy to fix. A few other simple IBIS fixes were mentioned. One attendee noted that if a V-T table does not match the I-V tables, the user has no recourse.

## CLOSING REMARKS

Mike LaBonte thanked the co-sponsors, presenters and attendees for their participation and support. The meeting adjourned at 4:30 PM.

## NEXT MEETING

The next IBIS Open Forum teleconference meeting will be held December 2, 2016. The Asian IBIS Summit in Tokyo will be held November 18, 2016. No teleconferences will be available for the Summit meeting.

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## NOTES

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This meeting was conducted in accordance with ANSI guidance.

All inquiries may be sent to [info@ibis.org](mailto:info@ibis.org). Examples of inquiries are:

- To obtain general information about IBIS.
- To ask specific questions for individual response.
- To subscribe to the official [ibis@freelists.org](mailto:ibis@freelists.org) and/or [ibis-users@freelists.org](mailto:ibis-users@freelists.org) email lists (formerly [ibis@eda.org](mailto:ibis@eda.org) and [ibis-users@eda.org](mailto:ibis-users@eda.org)).
- To subscribe to one of the task group email lists: [ibis-macro@freelists.org](mailto:ibis-macro@freelists.org), [ibis-interconn@freelists.org](mailto:ibis-interconn@freelists.org), or [ibis-quality@freelists.org](mailto:ibis-quality@freelists.org).
- To inquire about joining the IBIS Open Forum as a voting Member.
- To purchase a license for the IBIS parser source code.
- To report bugs or request enhancements to the free software tools: `ibischk6`, `tschk2`, `icmchk1`, `s2ibis`, `s2ibis2` and `s2iplt`.

The BUG Report Form for `ibischk` resides along with reported BUGs at:

<http://www.ibis.org/bugs/ibischk/>

<http://www.ibis.org/bugs/ibischk/bugform.txt>

The BUG Report Form for `tschk2` resides along with reported BUGs at:

<http://www.ibis.org/bugs/tschk/>

<http://www.ibis.org/bugs/tschk/bugform.txt>

The BUG Report Form for `icmchk` resides along with reported BUGs at:

<http://www.ibis.org/bugs/icmchk/>  
[http://www.ibis.org/bugs/icmchk/icm\\_bugform.txt](http://www.ibis.org/bugs/icmchk/icm_bugform.txt)

To report s2ibis, s2ibis2 and s2iplt bugs, use the Bug Report Forms which reside at:

<http://www.ibis.org/bugs/s2ibis/bugs2i.txt>  
<http://www.ibis.org/bugs/s2ibis2/bugs2i2.txt>  
<http://www.ibis.org/bugs/s2iplt/bugsplt.txt>

Information on IBIS technical contents, IBIS participants and actual IBIS models are available on the IBIS Home page:

<http://www.ibis.org/>

Check the IBIS file directory on [ibis.org](http://www.ibis.org) for more information on previous discussions and results:

<http://www.ibis.org/directory.html>

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## SAE STANDARDS BALLOT VOTING STATUS

Organization	Interest Category	Standards Ballot Voting Status	October	November	November	November
			14, 2016	4, 2016	11, 2016	14, 2016
ANSYS	User	Inactive	X	X	-	-
Broadcom Ltd.	Producer	Inactive	X	-	-	-
Cadence Design Systems	User	Active	X	X	X	X
Cisco Systems	User	Inactive	-	-	X	-
CST	User	Inactive	-	-	-	-
Ericsson	Producer	Active	-	-	X	X
GLOBALFOUNDRIES	Producer	Inactive	X	X	-	-
Huawei Technologies	Producer	Inactive	-	-	X	-
Infineon Technologies AG	Producer	Inactive	-	-	-	-
IBM	Producer	Inactive	X	X	-	-
Intel Corp.	Producer	Active	X	X	X	X
IO Methodology	User	Active	X	X	X	X
Keysight Technologies	User	Inactive	X	X	-	-
Maxim Integrated	Producer	Inactive	-	-	-	-
Mentor Graphics	User	Inactive	X	X	-	-
Micron Technology	Producer	Inactive	X	X	-	-
Signal Integrity Software	User	Active	X	X	X	X
Synopsys	User	Active	X	X	X	-
Teraspeed Labs	General Interest	Inactive	X	X	-	-
Xilinx	Producer	Inactive	-	-	-	-
ZTE	User	Inactive	-	-	X	-
Zuken	User	Inactive	-	-	-	-

Criteria for SAE member in good standing:

- Must attend two consecutive meetings to establish voting membership
- Membership dues current
- Must not miss two consecutive meetings

Interest categories associated with SAE standards ballot voting are:

- Users - members that utilize electronic equipment to provide services to an end user.
- Producers - members that supply electronic equipment.
- General Interest - members are neither producers nor users. This category includes, but is not limited to, government, regulatory agencies (state and federal), researchers, other organizations and associations, and/or consumers.