IBIS Open Forum Minutes

Meeting Date: **November 9, 2015**
Meeting Location: **Shanghai, China**

VOTING MEMBERS AND 2015 PARTICIPANTS

Altera	[David Banas], Masashi Shimanouchi, Hsinho Wu Amanda Liao*
ANSYS	(Steve Pytel), Curtis Clark
Applied Simulation Technology	Fred Balistreri, Norio Matsui
Avago Technologies	Minh Quach, Leif Zweidinger
Cadence Design Systems	Brad Brim, Joshua Luo, Ken Willis, Joy Li, Ambrish Varma Aileen Chen*, Lanbing Chen*, Wei Dai*, Zhiyu Guo* Jinsong Hu*, Rachel Li*, Ping Liu*, Yubao Meng* Zuli Qin*, Haisan Wang*, Yitong Wen*, Clark Wu* Janie Wu*, Benny Yan*, Haidong Zhang*, Wenjian Zhang* Zhangmin Zhong*
Cisco Systems	David Siadat, Rockwell Hsu, Bidyut Sen, Xu Yan*
CST	Stefan Paret, Matthias Troescher
Ericsson	Anders Ekholm*, Zilwan Mahmod*, Feng Shi* Wenyan Xie*, David Zhang*
Huawei Technologies	Xiaoqing Dong, Peng Huang*, Shuyao Liu* Huichao Weng*, Peng Xiao*, Mala Yu*, Cheng Zhang* Gezi Zhang*, Zhengyi Zhu*
IBM	Adge Hawes, Luis Armenta, Dale Becker
Infineon Technologies AG	Christian Sporrer
Intel Corporation	Michael Mirmak, Todd Bermensolo, Nhan Phan Gianni Signorini, Chunlei Guo, Shaowu Huang
IO Methodology	Lance Wang*
Keysight Technologies	Radek Biernacki, Pegah Alavi, Colin Warwick Jian Yang, Nicholas Tzou, Heidi Barnes, Dave Larson Kyla Thomas, Fangyi Rao, Yi Wang*, Xianzhao Zhao*
Maxim Integrated Products	Mahbubul Bari, Don Greer, Joe Engert, Joe Rayhawk Yan Liang
Mentor Graphics	Arpad Muranyi, Ed Bartlett, Vladimir Dmitriev-Zdorov
Micron Technology	Randy Wolff
Signal Integrity Software	Mike LaBonte*, Walter Katz, Todd Westerhoff Mike Steinberger
Synopsys	Ted Mido, Rita Horner, William Lau, Scott Wedge Michael Zieglmeier, Joerg Schweden, Xuefeng Chen* Lianpeng Sang*
Teraspeed Labs	Bob Ross, Tom Dagostino
Toshiba	(Yasumasa Kondo)
Xilinx	(Raymond Anderson)
ZTE Corporation	Tao Guo*, Fengling Gao*, Lili Wei*, Bi Yi*, Shunlin Zhu*

Zuken	Michael Schaeder, Markus Buecker, Griff Derryberry Ralf Bruening

OTHER PARTICIPANTS IN 2015

Advanced Semiconductor Engineering	Jane Yan
Avago Technologies	David Carkeek, James Church
Bayside Design	Elliot Nahas
Celestica	Sophia Feng*, Lei Liu*
Chinese Electronics Technology Company, Institute #52	Shujun Wei*
Ciena	Kaisheng Hu
Continental Automotive	Felix Goelden, Markus Bebendorf, Sebastian Groener Stefanie Schatt
eASIC	David Banas
Edadoc	Bruce Wu*, H. Zhang*
Freescale	Jon Burnett
Galbi Research	Dave Galbi
H3C Technologies	Xinyi Hu*, Lingqin Kong*, Haye Lee*
Honeywell International	Molly Xu*
IDEMWorks	Alessandro Chinea, Michelangelo Bandinu
Independent	Tim Wang Lee
Instituto de Telecomunicações	Wael Dghais
Integrated Device Technology	Billy Chen*
Jabil Design Services	Lurker Li*
KEI Systems	Shinichi Maeda
Lattice Semiconductor	Xu Jiang
Leading Edge	Pietro Vergine
Marvell	Weizhe Li*, Xike Liu*, Fang Lv*, Jie Pan*, Banglong Qian* Yuyang Wang*
Microchip Technology	Jeffrey Chou
Missouri University of Science and Technology	Albert Ruehli
NXP	Yanbin Chen*
Politecnico di Torino	Stefano Grivet-Talocia
Qualcomm	Senthil Nagarathinam, Kevin Roselle, Robin Han*
Rambus	John Yan, Joohee Kim, Sujit Kumar Wendem Beyene
Raytheon	Joseph Aday
SAE International	Chris Denham, Logen Johnson
SAIC Motor	Weng Yang*
Shanghai Faith Information	Miao He*, Bihui Shao*, Shuai Wang*
Shanghai Lefu Educational Technology	Peter Sun*, Leo Yi*

Siemens AG	Boris Kogan, Michael Flint
Simberian	Yuriy Shlepnev
SMICS	Xuejiao Qi*
Spreadtrum Communications	Linping Chen*, Yanbiao Chu*, Lily Dai*, Junyong Deng* Steven Guo*, Weiquan Jia*, Xiaobin Lu*, Mengying Ma* Ye Ping*, Zheng Qin*, Baoqin Su*, Tim Wang*, Nikki Xie* Honggiu Xu*, Eric Zhang*
Technische Universität Hamburg-Harburg	Jan Preibisch
Teledyne LeCroy	Yanan Cui*, Derek Hu*, Cici Wang*, Yifeng Wu*
University of Illinois	Jose Schutt-Aine
Vitesse	Siris Tsang
Xpeedic Technology	Wenliang Dia*, Qionghui Gui*, Zhouxiang Su* Mingcan Zhao*
Zhejiang Uniview Technologies	Busen Cai*, Weiqi Chen*
ZI Consulting	Iliya Zamek

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 13, 2015	Asian IBIS Summit Taipei – no teleconference	
November 16, 2015	Asian IBIS Summit Tokyo – no teleconference	
November 20, 2015	205 475 958	IBIS

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

https://ciscosales.webex.com/ciscosales/j.php?J=205475958

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. When calling into the meeting, follow the prompts to enter the meeting ID. For new, local international dial-in numbers, please reference the bridge numbers provided by Cisco Systems at the following link:

http://www.cisco.com/web/about/doing_business/conferencing/index.html

NOTE: "AR" = Action Required.

OFFICIAL OPENING

The Asian IBIS Summit took place on Monday, November 9, 2015 at the Parkyard Hotel in Shanghai. About 94 people representing 29 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/nov15a/

Lance Wang introduced Shuyao Liu, who welcomed participants on behalf of primary sponsor Huawei Technologies. 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. The primary sponsor was Huawei Technologies, and the co-sponsors were Cadence Design Systems, IO Methodology, Keysight Technologies, Synopsys, Teledyne LeCroy and ZTE Corporation.

IBIS CHAIR'S REPORT

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

Mike LaBonte described the activities of the IBIS Open Forum including its various specifications and formal standards, as well as the passage of IBIS 6.1. He introduced the new IBIS website and gave information on how to participate in IBIS activities. Mike said one of his goals as chair is to reduce the time that some BIRDs remain unresolved.

INTRODUCING IBIS VERSION 6.1

Michael Mirmak (Intel Corporation, USA)
[Presented by Mike LaBonte (Signal Integrity Software (SiSoft), USA)]

Mike LaBonte gave a brief overview of the major changes in IBIS Version 6.1, covering both the AMI and traditional IBIS portions. For the IBIS-AMI areas, model dependencies are supported, PAM4 is included, and bi-directionality is explicitly included. For traditional IBIS, initial delays are explicitly defined to assist with overclocking, and clarifications are made to package diagonals and package pin assignments for power delivery.

ENABLING FULL POWER-AWARE BUS SIMULATION WITH NON-IBIS DEVICE MODEL – A KIT USING IBIS [EXTERNAL MODEL]

Skipper Liang (Cadence Design Systems, ROC)
[Presented by Yitong Wen (Cadence Design Systems, PRC)]

Yitong Wen presented template IBIS files crafted to easily allow the use of [External Circuit]s implementing an entire complex DDR circuit to be analyzed in SPICE, not just a single buffer in a traditional IBIS simulation. Templates for both read and write modes are provided, with a

[Model Selector] to choose between them. The template IBIS files need to have the correct voltages set for each application. The read mode SPICE circuits require only the addition of a 1:1 voltage dependent voltage source to isolate the SPICE circuit from any load produced by the IBIS input buffer.

A PRACTICAL DOE APPLICATION IN STATISTICAL SI ANALYSIS USING IBIS & HOW CAN WE MAKE IBIS WORK BEYOND BEST CASE/WORST CASE?

Feng Shi*, Anders Ekholm**, Zilwan Mahmod** and David Zhang* (Ericsson, *PRC, **Sweden)
[Presented by Feng Shi (Ericsson, PRC)]

Feng Shi gave a brief overview of design of experiments (DOE) methodology in the context of a specific example of finding acceptable network topology and other settings using very fast response surface model technology. Step-by-step elimination of settings that did not matter much and settings that produced unacceptable results led to eye diagrams that were reasonably open in best and worst cases. She concluded by saying that engineers should increasingly use statistical/probability methods and that IBIS should allow for parameters that are expressed with confidence interval ranges and not only as “100% confidence” values.

IBIS INTERCONNECT BIRD UPDATE

Walter Katz (Signal Integrity Software (SiSoft), USA)
[Presented by Mike LaBonte (Signal Integrity Software (SiSoft), USA)]

Mike LaBonte gave an overview of the new IBIS [Interconnect Model] syntax proposed to allow IBIS-ISS subcircuits to be used as both on-die and package interconnect models. Mike showed a number of examples illustrating that broadband S-parameter models in Touchstone format would be supported, as well as diverse subsets of models for on-die and package interconnect, for signal nets and for power nets. Model makers would not be constrained to produce a single model for the whole device and could directly use the various circuits they already have on hand.

FEC APPLICATIONS FOR 25GB/S SERIAL LINK SYSTEMS

Tao Guo and Shunlin Zhu (ZTE Corporation, PRC)
[Presented by Tao Guo (ZTE Corporation, PRC)]

Tao Guo gave an overview of Forward Error Correction (FEC), which can relax maximum bit error rate (BER) requirements for 100Gb/s to 400Gb/s links. He described its application to 25Gb/s SerDes links, which results in significant improvements measured in terms of eye width and eye height in simulations that include crosstalk. A proposal was made for new IBIS-AMI parameters to support FEC in AMI models.

PAM4 SYSTEM SIMULATION USING AMI MODELS

Fangyi Rao (Keysight Technologies, USA)
[Presented by Yi Wang (Keysight Technologies, PRC)]

Yi Wang presented an introduction to Pulse Amplitude Modulation 4 (PAM4) signaling, how it differs from Non-Return to Zero (NRZ) signaling, and the implementation of PAM4 in IBIS-AMI.

SOME RESULTS FOR GENERAL K-TABLE EXTRACTION PROPOSAL USING SPICE

Bob Ross* and Xuefeng Chen** (*Teraspeed Labs, USA, **Synopsys, PRC)
[Presented by Xuefeng Chen (Synopsys, PRC)]

Xuefeng Chen showed how to use SPICE to prototype the generation of IBIS K-table data. This approach is based on the standard push-pull IBIS model approach, where power is fixed, not variable. The approach assumes fixed C_comp and known pin R, L, and C information. The approach also assumes iterative or looped feedback to convergence. This requires SPICE features that are not universal (not part of IBIS-ISS), such as tables and feedback loops. Source code for SPICE was shown, including transmission line loads and pulse (step) stimulus patterns.

Xuefeng noted that generalized C_comp can be supported, but any series R must be de-embedded. A K-amplifier will adjust to zero out the difference between the load and the voltage at the sense point. An alternative is to derive an IBIS model at the C_comp subcircuit terminal with appropriate K-tables.

Xuefeng showed several examples, including the standard IBIS ideal ramp, and reactive fixtures (L, C). The unstable case involves a package subcircuit alone, with no C_comp model but Lpkg and Cpkg defined and non-zero. The voltage out requires a discontinuity to cover the continuous slope and both reactive elements. S-parameter testing did in fact work, but only for delay-less structures. Feedback multiplier values did not have an impact. Having large L and C values are unlikely to generate smooth transitions in any case; the test may be unrealistic. The entire scheme fails for t-line models due to delays in the feedback loops.

IBIS SIMULATION CASE STUDY: UNEXPECTED GLITCH AND USING C_FIXTURE

Lance Wang (IO Methodology, USA)

Lance Wang presented simulation results showing artifacts that were dependent on the simulation time step used. The possible causes were explored, and it was found that not using C_fixture for SPICE extraction or making certain modifications to extracted IBIS V/T curves could lessen the artifacts. Lance reported that it appears some IBIS simulators completely ignore C_fixture values in IBIS files.

LAPLACE TRANSFORM TIME RESPONSE UTILITY

Bob Ross (Teraspeed Labs, USA)
[Presented by Anders Ekholm (Ericsson, Sweden)]

Anders Ekholm showed the spreadsheet utility produced by Bob Ross, explaining how it works and showing examples of the step responses produced by various Laplace input coefficients. The utility is fast and easy to use, but it requires some knowledge of Laplace transforms.

DISCUSSION

The attendees were polled to see how many were involved in making IBIS models, using IBIS-AMI models, and using Touchstone models. It was found that very few are working with Touchstone 2. Several issues were discussed, including the availability and quality of available IBIS models. One suggestion was extending IBIS to support power-aware IBIS-AMI models.

CLOSING REMARKS

Mike LaBonte thanked the co-sponsors, presenters and attendees for their participation and support. The meeting adjourned at 5:30 PM.

NEXT MEETING

The next IBIS Open Forum teleconference meeting will be held November 20, 2015. The following IBIS Open Forum teleconference meeting will be held December 18, 2015. The Asian IBIS Summit in Taipei will be held November 13, 2015. The Asian IBIS Summit in Tokyo will be held November 16, 2015. No teleconferences will be available for the Summit meetings.

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NOTES

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This meeting was conducted in accordance with ANSI guidance.

All inquiries may be sent to ibis-info@freelists.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 and/or ibis-users@freelists.org email lists (formerly ibis@eda.org and ibis-users@eda.org).
- To subscribe to one of the task group email lists: ibis-macro@freelists.org, ibis-interconn@freelists.org, or 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

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 for more information on previous discussions and results:

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

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IBIS – SAE STANDARDS BALLOT VOTING STATUS

Organization	Interest Category	Standards Ballot Voting Status	October 2, 2015	October 23, 2015	October 28, 2015	November 9, 2015
Altera	Producer	Active	X	X	X	X
ANSYS	User	Inactive	X	X	-	-
Applied Simulation Technology	User	Inactive	-	-	-	-
Avago Technologies	Producer	Inactive	-	-	-	-
Cadence Design Systems	User	Active	-	X	-	X
Cisco Systems	User	Inactive	-	-	-	X
CST	User	Inactive	X	-	-	-
Ericsson	Producer	Inactive	-	-	-	X
Huawei Technologies	Producer	Inactive	-	-	-	X
IBM	Producer	Inactive	-	-	X	-
Infineon Technologies AG	Producer	Inactive	-	-	-	-
Intel Corp.	Producer	Inactive	-	-	X	-
IO Methodology	User	Active	X	X	-	X
Keysight Technologies	User	Active	X	X	X	X
Maxim Integrated Products	Producer	Inactive	X	X	-	-
Mentor Graphics	User	Active	X	X	X	-
Micron Technology	Producer	Inactive	X	X	-	-
Signal Integrity Software	User	Active	X	X	X	X
Synopsys	User	Active	X	X	X	X
Teraspeed Labs	General Interest	Active	X	X	X	-
Toshiba	Producer	Inactive	-	-	-	-
Xilinx	Producer	Inactive	-	-	-	-
ZTE	User	Inactive	-	-	-	X
Zuken	User	Inactive	-	-	-	-

I/O Buffer Information Specification Committee (IBIS)

CRITERIA FOR 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 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.