IBIS Open Forum Minutes

Meeting Date: May 11, 2011 Meeting Location: SPI-E IBIS Summit, Naples, Italy

VOTING MEMBERS AND 2011 PARTICIPANTS

Agilent	Radek Biernacki, Fangyi Rao				
AMD	Nam Nguyen				
Ansys (Ansoft Corporation)	Samuel Martens				
Apple Computer	(Matt Herndon)				
Applied Simulation Technology	Norio Matsui				
ARM	(Nirav Patel)				
Cadence Design Systems	Terry Jernberg, Ambrish Varma, Dennis Nagle, Martin Biehl*				
Cisco Systems	Syed Huq, Mike LaBonte, Luis Boluna, Ashwin Vasudevan, Zhiping Yang				
Friesson	Anders Ekholm*				
Freescale	(Jon Burnett)				
Green Streak Programs	l vnne Green				
Hitachi ULSI Systems	(Kazuvoshi Shoii)				
Huawei Technologies	Xiaoging Dong				
IBM	Adge Hawes, Greg Edlund				
Infineon Technologies AG	(Christian Sporrer)				
Intel Corporation	Michael Mirmak, Udy Shrivastava				
IO Methodology	Lance Wang*				
LSI	Brian Burdick				
Mentor Graphics	Arpad Muranyi, Ed Bartlett, Vladimir Dmitriev-Zdorov, Steve Kaufer, Chuck Ferry				
Micron Technology	Randy Wolff*, Andrea Spiezia*, Roberto Izzi*, Aniello Viscardi*, Giovanni Guerra*, Francesco Madonna*, Giuseppe Fusillo*				
National Semiconductor	Hsinho Wu, Pegah Alavi, John Goldie				
Nokia Siemens Networks GmbH	Eckhard Lenski				
Signal Integrity Software	Walter Katz, Todd Westerhoff, Mike Steinberger, Barry Katz				
Sigrity	Raymond Chen, Kumar Keshavan, Yingxin Sun				
Synopsys	Andy Tai, Ted Mido, Scott Wedge				
Teraspeed Consulting Group	Bob Ross*, Kellee Crisafulli, Tom Dagostino, Scott McMorrow				
Texas Instruments	Casey Morrison, Alfred Chong				
Toshiba	(Yasumasa Kondo)				
Xilinx	(Raymond Anderson)				
ZTE	(Huang Min)				
Zuken	(Michael Schaeder)				

OTHER PARTICIPANTS IN 2011

AET	Mikio Kiyono
Altera	Hui Fu, Zhuyuan Liu, Julia Nekrylova
Avago	Weiping He, Minh Quach, Sari Tocco
Bayside Design	Elliot Nahas
Broadcom	Mohammad Ali
Exar Corporation	Helen Nguyen
Granite River Labs	Johnson Tan, Mike Engbretson, Quintin Anderson
High Speed Design Center	Ben Chia
ICT-Lanto	Steven Wong
KEI Systems	Shinichi Maeda
Maxim Integrated Products	Hassan Rafat
Oracle	Gustav Blando
Politecnico di Torino	Igor Stievano*, Stefano Grivet-Talocia*
Pristine Signals	AbdulRahman (Abbey) Rafiq
Renesas Electronics	Takuji Komeda
Siemens	Manfred Maurer*
Simberian	Yuriy Shlepnev
ST Microelectronics	Fabio Brina*, Alan Smith*
TechAmerica	(Chris Denham)
Thales Communication	Alexandre Amedeo*, Cyril Chastang*
University of Illinois	Jose Schutt-Aine*
University of L'Aquila	Danilo di Febo*
Vitesse Semiconductor	Sirius Tsang
Independent	Yoichi Niioka

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	
May 13, 2011	601 116 211	IBIS	

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

https://cisco.webex.com/cisco/j.php?J=601116211

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NOTE: "AR" = Action Required.

OFFICIAL OPENING

The IBIS Open Forum Summit was held in Naples, Italy at the Grand Hotel Santa Lucia following the 2011 SPI conference. About 20 people representing 11 organizations attended.

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

http://www.eda.org/ibis/summits/may11/

Lance Wang welcomed all the participants and thanked the co-sponsors Zuken and Micron. He asked all the participants to introduce themselves.

IBIS PROJECTS 2011

Bob Ross, Teraspeed Consulting Group

Bob Ross gave a summary of the IBIS organization including current activities. The current IBIS parser is version 5.0.6. IBIS-ISS is under review. A cleanup of the IBIS AMI specification is in progress. The IBIS specification is being reformatted into a true .doc/.pdf format. Model Connection Protocol is also in progress and Touchstone is being upgraded to version 2.1.

IBIS FILE: PROBLEMS & SOFTWARE SOLUTION

Francesco de Paulis, Antonio Orlandi, Danilo di Febo, University of L'Aquila, Italy

Danilo di Febo described that a large percentage of IBIS files generate errors and warnings when run through the IBIS checker. He helped develop the Uaq Healing IBIS Tool, version 2.5.1. The tool can automatically fix many common problems. The tool can upgrade the IBIS version and correct errors such as non-monotonic data. It can also add min and max values to C_comp and [Package] parasitics. Danilo showed simulation results before and after use of the tool to correct the model.

Randy Wolff asked how the tool corrects non-monotonic data. Is the strategy to correct a combined table or only individual tables of data? Danilo said the strategy is to correct individual tables. Manfred Maurer noted the correct place for usage of the tool is by the model provider, not by the designer. Danilo thought it was useful for engineers that understand the models to be able to correct old models. Another comment was that the use of the tool could be dangerous for model users that don't understand how much to 'correct' the model. Danilo encouraged everyone to provide feedback to improve the tool.

THE GOLDEN WAVEFORM FOR QA?

Manfred Maurer*, Christian Sporrer**, *Siemens AG, **Infineon Technologies AG, Germany

Manfred Maurer noted that an essential requirement from IBIS model users is the comparison of SPICE and IBIS simulation results. Quality reports are valuable, but there is no standard format for automated use and no automated way for checking QA criteria. The Golden Waveform container could be used to concentrate quality information. Model users can evaluate model quality by simulating with the TEST_LOAD. Manfred would like to see a second Golden Waveform generated with the IBIS model in an EDA tool (included in the model) to allow a user to check if their EDA tool gives similar results or incorrect results. He then showed examples of Golden Waveform data. He concluded with suggested improvements for better use of Golden Waveforms.

A question was asked if the t-line shown was part of the model data extraction. Manfred said that no, it should be part of the test load only for the Golden Waveform generation. Lance Wang asked about including Golden Waveforms from an IBIS simulation – what simulator do you use? Manfred did not suggest a specific simulator, but he assumed that any should give the same results. Anders Ekholm commented that measurement data cannot be included as Golden Waveforms, because package data cannot be included correctly.

FEATURE SELECTIVE VALIDATION

Danilo di Febo, Francesco de Paulis, Antonio Orlandi, University of L'Aquila, Italy

Danilo di Febo presented that the Uaq laboratory has developed a tool to compare datasets using Feature Selective Validation (FSV). Visual comparisons of datasets are not a good way of classifying levels of similarity. One method for FSV comparisons is Amplitude Difference Measure (ADM). A Feature Different Measure (FDM) can be computed and combined with ADM to generate a Global Different Measure (GDM). The measures report the number of points from the two datasets that fall within categories from excellent to very poor correlation. The tool is available free upon request.

Lance Wang asked if the tool is useful for comparing a large dataset or only for looking at small regions of the dataset. Danilo said you can zoom into a small region of interest. Randy Wolff asked if the datasets need to include the same sampling points. Danilo said no, the datasets can include different numbers of samples and are re-sampled within the tool before comparison. Bob Ross commented that there is another methodology (also called feature selective validation) compared measured features such as rise time and pulse width. How does this tool work with that kind of waveform data? Danilo said an FFT of the data would make for a valid comparison.

ICEM BASED MODEL FOR ICs EMC ANALYSIS

Antonio Maffucci*, Antonio Girardi**, Domenico Capriglione*, Andrea Chiariallo*, Roberto Izzi**, Ignazio Martines**, Giuseppe Fusillo**, Francessco Camarda**, Mauizio Bencivinni**, *University di Cassino, **Micron Technology, Italy

Antonio Maffucci presented that his group's task was to analyze the EMC behavior of some devices. Goals were to derive a circuit model for evaluating the currents flowing through the package pins and for evaluating the far field emissions. For measurements of DUTs, a test board was designed to minimize radiation from the board and guarantee signal integrity. The circuit model of the IC and package were based on a standard IEC ICEM approach. An S-parameter model was developed for the test board. The model for the far-field radiated emissions included analysis of loop areas of current within the IC's package. Antonio showed correlation between the model and measurement. He noted that the ICEM model gives good agreement for lower frequencies, but the model was not expected to be valid for higher frequencies. Antonio concluded that the model is good but has room for improvement such as for modeling cavity resonances within the circuit board.

A question was asked of what is the methodology for measuring the currents on the test board. Antonio said a high frequency probe (1GHz bandwidth) was used and it was most important to model the jumper inserted on the board for the probe. Another question was what was done to eliminate contributions from the test machine. Antonio said that much shielding was used. The IC was also put in a standby condition and background noise was measured and removed.

T-COILS AND BRIDGED-T NETWORKS

Bob Ross, Teraspeed Consulting Group, USA

Bob Ross introduced T-coils, noting that they are an old technology with current applications such as ESD compensation and bandwidth improvement. He showed improvements on a terminated multi-drop line, the trade-off being more delay in the system. He showed the application of Wang algebra to reduce the complexity of the circuit analysis equations. Many historical applications were shown. There are dozens of contributions in the literature in the last 10 years.

IC POWER DELIVERY MODELING

Igor Stievano*, Luca Rigazio*, Flavio Canavero*, T. R. Cunha**, J.C. Pedro**, H.M. Teixeira**, Antonio Girardi***, Roberto Izzi***, F. Vitale***, *Politecnico di Torino, Italy, *Instituto de Telecommunicacoes, Portugal, ***Micron Technology, Italy

Igor Stievano introduced the MOCHA project. Motivation for the project was to compute parameters from measured data and improve the model for a specific class of devices for System in Package (SiP) signal and power integrity analysis. I/O power rail modeling used a cascade connection of lumped RLC cells. The IC core power delivery model was an equivalent impedance of a Norton equivalent. The current source modeling the core can be derived from numerical simulation. Examples of simulation and measurement correlation were shown. Simulation and measurement were in good agreement when all the cascaded models were included.

Igor added that motivation for the project was to develop the simplest model possible.

BIRD95 AND BIRD98 SIMULATIONS

Randy Wolff*, Lance Wang**, *Micron Technology, **IO Methodology, USA Randy Wolff investigated BIRD95 and BIRD98 implementations in two EDA software tools. An IBIS 5.0 model was developed for a DDR3 device that included [Composite Current], [ISSO PU] and [ISSO PD] tables. He noted that adding [Composite Current] data to the model reduced the valid switching rate of the model. He showed examples of the data tables added to the model. IBISCHK5 was found to be too sensitive with its checks on [ISSO PU] and [ISSO PD] data. Warnings were issued that seemed non-useful.

Randy showed simulation results from the two software tools. Four simulations were run with different package models to test BIRD95 and BIRD98 information separately as well as to look at a realistic SSO simulation. VCCQ and VSSQ currents were compared to the original SPICE results. A BUG was found with one of the tools related to over-clocking. VCCQ currents did match well with both tools using a simple package model, but VSSQ currents did not look as good. With a realistic package modeling including inductance and coupling, the results did not match very well with SPICE. Randy concluded that the algorithms could use further improvement.

Anders Ekholm asked how he handled package modeling. Randy said that a SPICE subcircuit was used since IBIS incorrectly models on-die decoupling.

CONTINUOUS AND DISCRETE MODELING FOR IBIS-AMI

Bob Ross, Teraspeed Consulting Group, USA

Bob Ross presented methods for relating Laplace transforms, differential equations, difference equations and the Z transform. The methods are useful in IBIS AMI for relating tap coefficients to continuous functions. Bob demonstrated a spreadsheet he developed to do a recursive Taylor series. Many of these functions are built into math programs such as Matlab and can be useful for AMI modeling.

CONCLUDING ITEMS

Lance Wang closed the meeting by thanking the co-sponsors and the presenters. He also thanked all the attendees for making the meeting a success. The meeting concluded at approximately 5:30 PM.

NEXT MEETING

The next IBIS Open Forum teleconference will be held May 13, 2011 from 8:00 to 10:00 AM US Pacific Standard Time.

NOTES

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VICE CHAIR: Lance Wang (978) 633-3388 <u>Iwang@iometh.com</u> President/CEO, IO Methodology, Inc. PO Box 2099 Acton, MA 01720

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This meeting was conducted in accordance with the GEIA Legal Guides and GEIA Manual of Organization and Procedure.

The following e-mail addresses are used:

majordomo@eda.org

In the body, for the IBIS Open Forum Reflector: subscribe ibis <your e-mail address>

In the body, for the IBIS Users' Group Reflector: subscribe ibis-users <your e-mail address>

Help and other commands: help

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To join, change, or drop from either or both: IBIS Open Forum Reflector (<u>ibis@eda.org</u>) IBIS Users' Group Reflector (<u>ibis-users@eda.org</u>) State your request.

ibis-info@eda.org

To obtain general information about IBIS, to ask specific questions for individual response, and to inquire about joining the EIA-IBIS Open Forum as a full Member.

ibis@eda.org

To send a message to the general IBIS Open Forum Reflector. This is used mostly for IBIS Standardization business and future IBIS technical enhancements. Job posting information is not permitted.

ibis-users@eda.org

To send a message to the IBIS Users' Group Reflector. This is used mostly for IBIS clarification, current modeling issues, and general user concerns. Job posting information is not permitted.

ibis-bug@eda.org

To report ibischk parser BUGs as well as tschk2 parser BUGs. The BUG Report Form for ibischk resides along with reported BUGs at:

http://www.eda.org/ibis/bugs/ibischk/ http://www.eda.org/ibis/bugs/ibischk/bugform.txt

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

http://www.eda.org/ibis/tschk_bugs/ http://www.eda.org/ibis/tschk_bugs/bugform.txt

icm-bug@eda.org

To report icmchk1 parser BUGs. The BUG Report Form resides along with reported BUGs at:

http://www.eda.org/ibis/icm_bugs/ http://www.eda.org/ibis/icm_bugs/icm_bugform.txt

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

http://www.eda.org/ibis/bugs/s2ibis/bugs2i.txt http://www.eda.org/ibis/bugs/s2ibis2/bugs2i2.txt

http://www.eda.org/ibis/bugs/s2iplt/bugsplt.txt

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

http://www.eda.org/ibis

Check the IBIS file directory on eda.org for more information on previous discussions and results:

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

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IBIS CURRENT MEMBER VOTING STATUS

I/O Buffer Information Specification Committee (IBIS)

Standards									
Organization	Interest Category	Voting Status	March 11, 2011	April 1, 2011	April 22, 2011	May 11, 2011			
Advanced Micro Devices	Producer	Active	-	Х	Х	-			
Agilent Technologies	User	Active	Х	Х	Х	-			
Ansys	User	Inactive	-	-	-	-			
Apple Computer	User	Inactive	-	-	-	-			
Applied Simulation Technology	User	Inactive	-	-	-	-			
ARM	Producer	Inactive	-	-	-	-			
Cadence Design Systems	User	Inactive	Х	-	-	Х			
Cisco Systems	User	Active	Х	Х	Х	-			
Ericsson	Producer	Active	Х	Х	-	Х			
Freescale	Producer	Inactive	-	-	-	-			
Green Streak Programs	General Interest	Inactive	-	-	-	-			
Huawei Technologies	Producer	Inactive	-	-	-	-			
Hitachi ULSI Systems	Producer	Inactive	-	-	-	-			
IBM	Producer	Inactive	Х	Х	-	-			
Infineon Technologies AG	Producer	Inactive	-	-	-	-			
Intel Corp.	Producer	Active	Х	Х	Х	-			
IO Methodology	User	Active	Х	Х	Х	Х			
LSI	Producer	Inactive	Х	-	-	-			
Mentor Graphics	User	Active	Х	Х	Х	-			
Micron Technology	Producer	Active	Х	Х	-	Х			
National Semiconductor	Producer	Inactive	-	-	-	-			
Nokia Siemens Networks	Producer	Inactive	Х	Х	-	-			
Signal Integrity Software	User	Active	Х	Х	Х	-			
Sigrity	User	Inactive	-	-	Х	-			
Synopsys	User	Inactive	-	-	-	-			
Teraspeed Consulting	General Interest	Active	Х	Х	Х	Х			
Texas Instruments	Producer	Inactive	-	-	-	-			
Toshiba	Producer	Inactive	-	-	-	-			
Xilinx	Producer	Inactive	-	-	-	-			
ZTE	User	Inactive	-	-	-	-			
Zuken	User	Inactive	-	-	-	-			

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- MUST ATTEND TWO CONSECUTIVE MEETINGS TO ESTABLISH VOTING MEMBERSHIP
- MEMBERSHIP DUES CURRENT

MUST NOT MISS TWO CONSECUTIVE MEETINGS

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