IBIS Open Forum Minutes

Meeting Date: **November 16, 2018**
Meeting Location: **Taipei, Taiwan**

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Xrossvate	Toshiyuki Kaneko
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Zheijiang YUSHI Technology	E. Deng

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 30, 2018	624 227 121	IBISfriday11

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

http://tinyurl.com/y7yt7buz

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.

OFFICIAL OPENING

The Asian IBIS Summit took place on Friday, November 16, 2018 at the Sherwood Hotel in Taipei. About 47 people representing 17 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/nov18c/

Mike LaBonte opened the summit by welcoming everyone and thanking the sponsors Cadence Design Systems, KairosTech Innovation (on behalf of SPISim), Synopsys, and IO Methodology. He noted that minutes of the meeting would be posted. There would be two breaks for refreshments and vendor interaction, and free lunch.

IBIS UPDATE

Mike LaBonte (SiSoft, USA)

The status and activities of the IBIS Open Forum were described. Mike showed the progress on development of the IBIS 7.0 specification, which he estimated might be ratified in March of 2019, if all goes well. Mike noted that few BIRDs were currently in the pipeline for further development, encouraging the audience to consider submitting their own ideas for IBIS. He planned to give a short walk-through of the BIRD submission and adoption process during final discussion, if time would permit.

A PRACTICAL METHODOLOGY FOR SERDES DESIGN
Amy Zhang*, Guohua Wang*, David Zhang*, Zilwan Mahmod*, Anders Ekholm** (Ericsson, *PRC, **Sweden)
[Presented by Amy Zhang (Ericsson, PRC)]

Analyzing a SerDes channel to find the best case operation involves not only many combinations of driver and receiver settings, but also a significant number of interconnect characteristics that must be explored under typ/min/max conditions. Simulating 1 million bits across all possible variations for one example would take 506.25 days. The challenge is to make satisfactory design decisions without running many simulations. Ideally, we would create an equation that quickly models system performance, given all of the system condition inputs that can vary. This can be done using Design of Experiments (DOE) methods to statistically sample the parameter space, producing a Response Surface Model (RSM) using relatively few simulations. A CEI-28g example was shown, with the quality of the RSM fit evaluated. Sensitivity analysis was used to assign a different sampling distribution to each factor. Millions of conditions were then evaluated very quickly. Increasingly, we will find that the best/worst case analysis supported by typ/min/max data will not suffice for design closure. Adding an option for IBIS-AMI to represent a full distribution of data would help with DOE analysis, and would allow for predicting performance confidence intervals.

CHARACTERIZING AND MODELING OF A CLAMPED NON-LINEAR CTE/AGC
Skipper Liang (Cadence Design Systems, ROC)

Skipper summarized his 2017 presentation describing a Thevenin equivalent circuit method for characterizing a Continuous Time Equalizer (CTE). The Device Under Test (DUT) could include an Automatic Gain Control (AGC), as long as the condition of linearity was met. The technique involved scaling voltages, so it was important that the DUT have the same characteristics at any voltage, since scaled results would be normalized to actual. In reality, clamping diodes were usually present, causing non-linear effects. One approach is to use a small signal input of 20mV, which captures the high frequency behavior well, but misses the DC behavior. The large signal approach would be to use a 100mV input, but that fails to capture the high frequency response while successfully capturing the DC behavior. To produce a single model that performs well in all cases, a model was constructed in which separate code blocks captured the small signal and large signal behaviors. A method to find the linear voltage range was described. It was found that a hyperbolic tangent function could be used to model the non-linear behavior of clamping diodes, and iterating to find the best coefficients would yield acceptable results for mapping input voltage to output voltage. This was suitable for use in AMI_GetWave. However, the frequency response of the hyperbolic tangent function model

could not be directly derived, because the function fails one of the criteria to be Fourier transformable. A solution to that involved using an equivalent hyperbolic cosecant function to derive the Fourier transform, for use in statistical analysis. Two examples using CTE and AGC were shown, each with good correlation to measurement.

MODEL CORRELATION FOR IBIS-AMI
Wenyan Xie*, Guohua Wang*, David Zhang*, Anders Ekholm** (Ericsson, *PRC, **Sweden)
[Presented by Anders Ekholm (Ericsson, Sweden)]

Once simulation results are correlated to corresponding measured results, simulation can be used to verify cases that are beyond the scope of measurement. A method for correlating IBIS-AMI Tx models was described. A slow clock pattern made it easier to compare edges and amplitudes, and also to compare FFE tap action. Each tap setting was swept across all values, and correlation evaluated for each. It is necessary to achieve good correlation for the Tx first, because it will be used to drive the Rx for Rx correlation. Sweeping Tx FFE tap settings again, the Rx eye at the decision point was monitored. Some devices have an internal ability to report the internal Rx eye. Example correlation results for eye width and height were shown. Time domain waveforms can also be compared using Figure of Merit (FOM) or Feature Selective Validation (FSV). More than the usual 5 FSV metrics should be used, each weighted differently. The example was correlated against only typical silicon. We do not know the span of real silicon performance that IBIS-AMI min and max corners captures. Having models with statistical distributions for each parameter would be better.

STUDY OF DDR ASYMMETRIC RT/FT IN EXISTING IBIS-AMI FLOW
Wei-kai Shih*, Wei-hsing Huang** (SPISim, *Japan, **USA)
[Presented by Wei-hsing Huang (SPISim, USA)]

Wei-hsing described how statistical and time domain IBIS-AMI flows worked. For asymmetric rise/fall, Wei-kai described a method for deriving a fall edge from the rise edge, or vice-versa, using a transfer function. He noted it would still be necessary for IBIS-AMI to know the common mode DC offset for single-ended signals. Wei-kai showed example pseudo-code for the transfer function to recover a fall response from the rise response. This could be used to construct eye diagrams with rise/fall asymmetry. A recursive algorithm for calculating eye PDF with asymmetric rise/fall was described. Simulating bit-by-bit with Tx and Rx AMI_GetWave should work well, but there would be glitches if convolution was involved at the Rx. Pseudo-code for the AMI_GetWave process was shown.

OPEN DISCUSSION
During the time for open discussion, Mike LaBonte gave two ad-hoc presentations. The first included a subset of slides from Mike's presentation from the September 2017 EDICON IBIS Summit in Boston. Mike noted that previous speakers had described the challenges of proving low bit error rates using time domain simulations, and a method by which statistical analysis could be performed to calculate very low probability events. He showed the numbers of error free bits required to prove 1e-12 BER with various confidence levels, which were impractical to achieve in simulators. In one example, statistical analysis was able to predict 6e-12 BER. Extrapolation of time domain results using statistical results could provide the benefits of both

time domain simulation, to model adaptive behavior, and statistical simulation, to prove lower BER requirements.

Mike also showed the IBIS website to explain the process by which the IBIS specification is developed. BIRD documents are written by people from one or more organizations using a template, and submitted to the IBIS Chair. Often there are multiple authors, from different companies. The BIRD includes a statement of the issue to be addressed, particular requirements for the solution, and proposed changes to the current IBIS specification to meet the requirements. Anyone may submit a BIRD, but only official IBIS members may vote. The BIRD is discussed in meetings, sometimes over an extended period, and finally a vote to accept it is taken in an IBIS Open Forum meeting. If it passes, the BIRD eventually will be incorporated into a future IBIS specification produced by the IBIS Editorial Task Group.

CLOSING REMARKS
In closing, Mike LaBonte thanked the sponsors, authors, presenters, and all participants for their support of IBIS and for good discussions. The meeting was adjourned.

NEXT MEETING
The next IBIS Open Forum teleconference meeting will be held on November 30, 2018. The following IBIS Open Forum teleconference meeting is tentatively scheduled on December 21, 2018.

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NOTES

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This meeting was conducted in accordance with ANSI guidance.

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- 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

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> 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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SAE STANDARDS BALLOT VOTING STATUS

Organization	Interest Category	Standards Ballot Voting Status	November 2, 2018	November 12, 2018	November 14, 2018	November 16, 2018
ANSYS	User	Inactive	X	X	-	-
Applied Simulation Technology	User	Inactive	-	-	-	-
Broadcom Ltd.	Producer	Inactive	-	-	-	-
Cadence Design Systems	User	Active	X	X	X	X
Cisco Systems	User	Inactive	-	-	-	-
CST	User	Inactive	-	-	-	-
Ericsson	Producer	Active	X	X	X	X
GLOBALFOUNDRIES	Producer	Inactive	X	-	-	-
Huawei Technologies	Producer	Inactive	-	-	-	-
IBM	Producer	Inactive	X	-	-	-
Infineon Technologies AG	Producer	Inactive	-	-	-	-
Intel Corp.	Producer	Active	X	-	X	X
IO Methodology	User	Inactive	-	-	X	-
Keysight Technologies	User	Inactive	X	X	-	-
Maxim Integrated	Producer	Inactive	-	-	-	-
Mentor, A Siemens Business	User	Active	X	X	X	-
Micron Technology	Producer	Inactive	X	X	-	-
NXP	Producer	Inactive	-	-	-	-
Raytheon	User	Inactive	-	-	-	-
SiSoft	User	Active	X	X	X	X
Synopsys	User	Active	X	X	X	-
Teraspeed Labs	General Interest	Inactive	X	-	-	-
Xilinx	Producer	Inactive	-	-	-	-
ZTE Corp.	User	Inactive	-	-	X	-
Zuken	User	Inactive	-	X	-	-

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.