



IBIS Open Forum Minutes

Meeting Date: **November 19, 2021**

Meeting Location: **Virtual Asian IBIS Summit (China)**

VOTING MEMBERS AND 2021 PARTICIPANTS

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In the list above, attendees at the meeting are indicated by *. Those submitting an email ballot for their member organization for a scheduled vote 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.

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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 Virtual Asian IBIS Summit (China) took place on Friday, November 19, 2021, as an online virtual meeting. About 64 people representing 22 organizations attended.

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

<https://ibis.org/summits/nov21b/>

Start times and durations listed in these minutes refer to the meeting recording linked at:

https://ibis.org/summits/nov21b/summit_recording.mp4

(Start time: 00:00, Duration: 3:30)

Randy Wolff (IBIS Open Forum) welcomed everyone to the meeting. He showed where the agenda and presentations could be found online. Lance Wang encouraged participants to ask questions in English, if possible, but he would assist with questions asked in Chinese. The meeting would be recorded.

IBIS CHAIR'S REPORT

Randy Wolff (Micron Technology, USA)

(Start time: 04:00, Duration: 18:30)

Randy Wolff, IBIS Open Forum Chair, presented on the history and current status of the IBIS Open Forum. Most of the current work was in completing the IBIS 7.1 specification. A new parser for Touchstone 2.0, tschk2.0.1, had been released. Some specification change BIRDS were not to be included in IBIS 7.1. Some BIRDS would be rejected, in favor of newer BIRDS that were accepted. Future work would include expanding the system level perspective, PAMn, and PDN modeling and analysis improvements. Randy encouraged participation by all in the IBIS development process, showing the website features that could be used for collaboration.

EXPECTATIONS FOR IBIS 7.1

Randy Wolff (Micron Technology, USA)
(Start time: 23:00, Duration: 23:40)

Randy Wolff presented by video recording an overview of the new changes to be expected in IBIS 7.1. The presentation was an update to one previously given by Michael Mirmak of Intel. Randy described the process used by the Editorial Task Group to merge the changes specified by each BIRD into the IBIS 7.0 specification to produce IBIS 7.1. He said the Editorial Task Group work had completed, and a final draft had been introduced in the October 29 IBIS Open Forum meeting. Randy described changes in C_comp modeling, on-die Power Distribution Networks (PDNs), Electrical Module Descriptions (EMD), DC offset, back-channel statistical optimization, IBIS-AMI sampling position, and IBIS-AMI clock forwarding support. He encouraged all to review the draft IBIS 7.1 documents found on the IBIS website. Randy said a second review of IBIS 7.1 draft would take place the next day in the IBIS Open Forum meeting. A vote to approve it was expected December 10. An ibischk parser updated for IBIS 7.1 was expected to be released at the same time. Randy showed where to find the draft IBIS 7.1 documents on the website.

MODELING AND SIMULATION OF SINGLE-ENDED PAM4 SIGNALS IN MEMORY INTERFACES

Fangyi Rao (Keysight Technologies, USA)
(Start time: 48:00, Duration: 41:40)

Fangyi Rao described the data rates and use of PAM4 signaling for GDDR6X. The reduced level separation of PAM4 required comprehensive modeling and analysis. Analysis of single-ended signals and source-synchronous clocking was required. Modeling the correct DC offset was important for single-ended signal analysis. Simulating the difference between rising and falling waveform edges, as well as non-linear transmitter behavior, were also important. Fangyi described the use of Signal-to-Noise-and-Distortion-Ratio (SNDR) for further analysis. He showed the effects of various equalization techniques, and how IBIS had been extended to model clock forwarding, which interacted with the ability of a receiver to track jitter.

Randy Wolff asked about mapping to levels since that would be dependent on the channel characteristics. Fangyi said that mapping would be non-linear and handled in the algorithmic domain. He asked Randy how non-linear it might be. Randy referenced GDDR6X technology, saying the ODT options were not designed to work over a very wide range of conditions. Fangyi agreed more study might be warranted. Xuefeng Chen commented that it seemed the top and bottom eyes looked the same in the Nonlinear Tx image, asking if that meant they had the same slew rate. Fangyi answered that we did not have enough data to define whether it was symmetric. This topic also was brought up in ATM meetings as well. More studies were needed. Fangyi wished that chip vendors could provide more data to support that. Ling Li asked whether the AMI model used in the simulation was extracted from lab measurements or generated as Spice or S-parameters. Fangyi answered that users could extract the data using different means. Ling also asked whether the EDA tools would optimize the DFE/FFE tap numbers. Fangyi answered that the algorithms were built into the AMI models, not the EDA tools.

USING [DRIVER SCHEDULE] FOR PAM4 TESTING

Bob Ross (Teraspeed Labs, US), Xuefeng Chen (Synopsys, PRC)

(Start time: 1:30:20, Duration: 26:00)

Xuefeng Chen presented on the use of IBIS [Driver Schedule] models for evaluating PAM4 designs. He described previous, related work by Randy Wolff and Fangyi Rao. Two Open-drain and two Open-source devices could be combined to implement an output impedance that could change dynamically among four levels. He explained how [Driver Schedule] would work to trigger a short programmed PAM4 symbol sequence. A comparison with a PAM4 IBIS-AMI model showed good correlation, although the [Driver Schedule] output was too short to fill in a full range of probabilities. One challenge was using a single, fixed C_comp, whereas a PAM4 driver would have a more complex die capacitance characteristic. Xuefeng suggested a script might be written to automate creating [Driver Schedule] syntax for any given symbol pattern.

Randy Wolff asked about the difficulty in creating the model. Bob Ross said it took some time to create, and then Xuefeng made some corrections to it. Xuefeng said scheduling longer patterns was difficult. Randy noted that the output was fixed to a preset data rate. Bob felt it was a promising experiment.

AN EFFICIENT ANALYSIS METHOD FOR IBIS EYE-DIAGRAM EDGE ANALYSIS BASED ON PDA

Wei He, Jianfeng Xia, Yufeng Dan, Chengzhi Hu (Xpeedic, PRC)

(Start time: 1:49:00, Duration: 32:40)

Wei He described challenges encountered performing eye diagram analysis of high speed systems. It was necessary to model at least factors impacting signal quality. Time domain simulation would capture non-LTI effects, but it was very time consuming. Wei described the statistical analysis method, which was faster and able to represent lower bit rate errors but would not model non-LTI effects. Peak Distortion Analysis (PDA) focused on worst case bit patterns. He described SBR and DER approaches for creating worst case PDA eye masks. Crosstalk could be accounted for. Wei compared SBR, DER, MER4, and MER8 methods, showing results for a CPU to memory bus analysis. He recommended PDA, outlining the unique advantages of the SBR, DER, and MER methods.

Ling Li asked what the MER acronym stood for. Wei said it was Multiple Edge Response.

THE IMPACT OF CROSSTALK ON 56G+ SERDES SIGNALS

Jinlong Li, Zhongmin Wei, Bi Yu (ZTE Corporation, PRC)

(Start time: 2:23:30, Duration: 10:00)

Jinlong Li presented on the importance of crosstalk analysis for PAM4 signaling, which required discriminating among smaller voltage level changes. He described the various contributors to crosstalk, and their sensitivities to factors such as line width. He showed a technique for reducing line to pad crosstalk by varying the line width. Tests showed that ICN could be reduced by 80 percent. Via to via crosstalk could be reduced by a pattern change. The impact of crosstalk on Channel Operating Margin (COM) was analyzed.

FSV: AN INTRODUCTION

Gang Zhang (Harbin Institute of Technology, PRC)

(Start time: 2:36:15, Duration: 23:00)

Gang Zhang presented an introduction to the IEEE Feature Selective Validation (FSV) method, beginning with a history of electronic signal simulation validation efforts. Visual evaluation was used in the 1990s. Visual evaluation had its limits, especially when a set of correlation images seemed similar. Objective techniques borrowed from other disciplines were found unsuitable, and the nature of signal data, for which both amplitude and time mattered, was the problem. A visual rating scale method was developed to study the variations in how people evaluated correlations. A metric incorporating an Amplitude Difference Measure (ADM) and a Frequency Difference Measure (FDM) was developed, as well as set of thresholds for quality rating. FSV values for several cases were shown, along with the distributions of subjective visual evaluations. Gang discussed further analyses performed to evaluate the suitability of FSV for different data types. The selection of data portions for evaluation also required consideration. Gang showed a case study in which FSV was used to validate complex plane return path simulations.

FAST PDN IMPEDANCE PREDICTION USING DEEP LEARNING

Ling Zhang (Zhejiang University Hangzhou, PRC)

(Start time: 3:00:30, Duration: 20:00)

Ling Zhang described the limitations of models used for calculation of power delivery network plane impedances. The cavity impedance model could handle only rectangular shapes. The plane pair PEEC model could handle irregular shapes, but it was slow. They explored the use of deep learning models to predict impedance quickly, with sufficient accuracy. Doing so required producing a significant amount of training data. A boundary integration solver was chosen because it was much faster than full wave, running in less than 5 seconds versus greater than 20 minutes. Training cases with random shapes, decoupling capacitors and stackups were generated and solved with boundary integration, and these were used to train a convolutional neural network. That required about 80 hours of compute time. The neural network model was then able to solve the training cases much more quickly than the Boundary Element Method (BEM), and the accuracy was tolerable. The files were available on GitHub.

Xuefeng Chen asked which area was more sensitive in the results. Ling said that the first one, the distance between power/ground plane and top/bottom layers, was very sensitive. Also, the distance between IC and decoupling capacitor was very sensitive. Lance Wang commented that on slide 11 the results shown were very good, asking how much of the data were deemed not very accurate. Ling said the images shown were for the more accurate cases. Of the total data, about 10%+ were deemed not very accurate. Model improvements were needed, and they would study further.

DISCUSSION AND CONCLUDING ITEMS

(Start time: 4:23:50, Duration: 2:30)

Randy Wolff said he hoped to meet in person the following year. He thanked the presenters, Bob Ross, Lance Wang and the other IBIS board members for their work organizing the summit. The meeting was concluded.

NEXT MEETING

The next meeting would be the IBIS Open Forum teleconference meeting, to be held on November 19, 2021.

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NOTES

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- 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.

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

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Organization	Interest Category	Standards Ballot Voting Status	October 8,	October 29,	November	November
			2021	2021	12, 2021	19, 2021
ANSYS	User	Inactive	X	X	-	-
Applied Simulation Technology	User	Inactive	-	-	-	-
Broadcom Ltd.	Producer	Inactive	-	-	-	-
Cadence Design Systems	User	Active	X	X	X	X
Celestica	User	Inactive	-	-	-	-
Cisco Systems	User	Inactive	-	-	-	X
Dassault Systemes	User	Inactive	-	-	-	-
Ericsson	Producer	Inactive	-	-	-	-
Google	User	Inactive	X	X	-	-
Huawei Technologies	Producer	Inactive	-	-	-	X
Infineon Technologies AG	Producer	Inactive	X	-	-	-
Instituto de Telecomunicações	User	Inactive	-	-	-	-
Intel Corp.	Producer	Inactive	X	X	-	-
Keysight Technologies	User	Active	X	-	X	X
Luminous Computing	General Interest	Inactive	-	-	-	-
Marvell	Producer	Inactive	-	X	-	-
MathWorks (SiSoft)	User	Active	X	X	X	X
Maxim Integrated	Producer	Inactive	X	X	-	-
Micron Technology	Producer	Active	X	X	X	X
MST EMC Lab	User	Inactive	X	-	-	X
NXP	Producer	Inactive	-	-	-	-
SerDesDesign.com	User	Inactive	-	-	-	-
Siemens EDA (Mentor)	User	Active	X	X	X	-
Synopsys	User	Active	-	-	X	X
Teraspeed Labs	General Interest	Active	X	X	X	X
Xilinx	Producer	Inactive	X	X	-	-
ZTE Corporation	User	Inactive	-	-	-	X
Zuken	User	Active	-	-	X	X

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- Membership dues current
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