



IBIS Open Forum Minutes

Meeting Date: **May 26, 2022**

Meeting Location: **Virtual European IBIS Summit at SPI 2022**

VOTING MEMBERS AND 2022 PARTICIPANTS

AMD (Xilinx)	(Bassam Mansour)
Analog Devices (Maxim Integrated)	Tushar Pandey, Jermaine Lim*, Rolynd Aquino*, Aprille Hernandez-Loyola*, Janchris Espinoza*, Francis Ian Calubag*, Toni Rose Racelis*
ANSYS	Curtis Clark
Applied Simulation Technology	(Fred Balistreri)
Broadcom	(Yunong Gan), Jim Antonellis*
Cadence Design Systems	Zhen Mu, Jared James, Ken Willis
Celestica	(Sophia Feng)
Cisco Systems	(Stephen Searce)
Dassault Systemes	(Stefan Paret), Longfei Bai*
Ericsson	(Guohua Wang)
Google	(Hanfeng Wang)
Huawei Technologies	(Hang (Paul) Yan)
Infineon Technologies AG	(Christian Sporrer)
Instituto de Telecomunicações	(Abdelgader Abdalla)
Intel Corporation	Hsinho Wu, Michael Mirmak, Jingbo Li, Liwei Zhao
Keysight Technologies	Radek Biernacki, Ming Yan, Fangyi Rao, Majid Ahadi Dolotsara, Pegah Alavi, Saish Sawant
Luminous Computing	(David Banas)
Marvell	Steven Parker
MathWorks	Walter Katz
Micron Technology	Randy Wolff*, Aniello Viscardi*, Justin Butterfield*, Dragos Dimitriu*
MST EMC Lab	(Chulsoon Hwang)
SerDesDesign.com	John Baprawski
Siemens EDA	Arpad Muranyi*, Weston Beal, Amin Maher, Scott Wedge, Steve Kaufer, Todd Westerhoff, Vladimir Dmitriev-Zdorov*, Ken Cantrell*
STMicroelectronics	(Olivier Bayet)
Synopsys	Ted Mido
Teraspeed Labs	Bob Ross*
Waymo	Zhiping Yang
ZTE Corporation	(Shunlin Zhu)
Zuken	(Michael Schäder)
Zuken USA	Lance Wang*

OTHER PARTICIPANTS IN 2022

Amazon Lab126	Ashkar Hashemi
Ampere Computing	Le Duy Quang*
CEMWorks	Cielo Gerrie*
Ciena	Hugues Tournier
IBM	Greg Edlund
Imperial College, UK	Cong Ling*

Mercury Systems
National Central University, Taiwan

OVT
SAE ITC
SeriaLink Systems
University of Colorado, Boulder, ECEE
University of Illinois
Politecnico di Torino

Unaffiliated

Vincent Tam
Chiu-Chih Chou*, Liu Huang Fu*, Bohong Chai*,
Remxiang Xu*, Kuan Fa*, Yanting Li*
Sirius Tsang
José Godoy
Aleksy Tyshchenko, David Halupka
Eric Bogatin
José Schutt-Aine*
Stefano Grivet Talocia*, Tommaso Bradde*,
Marco De Stefano*, Riccardo Trincherio*,
Alessandro Zanco*, Antonio Carlucci*
Mike LaBonte*

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.

UPCOMING MEETINGS

The connection information for future IBIS teleconferences is as follows:

Microsoft Teams meeting

Join on your computer or mobile app

[Click here to join the meeting](#)

Join with a video conferencing device

106010980@teams.bjn.vc

Video Conference ID: 114 666 897 5

[Alternate VTC dialing instructions](#)

Or call in (audio only)

[+1 267-768-8015,554664847#](tel:+12677688015554664847) United States, Philadelphia

Phone Conference ID: 554 664 847#

[Find a local number](#) | [Reset PIN](#)

[Learn More](#) | [Meeting options](#)

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 European IBIS Summit at SPI 2022 took place on Thursday, May 26, 2022, as a virtual meeting. About 35 people representing 13 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/may22/>

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

https://ibis.org/summits/may22/summit_recording.mp4

Randy Wolff opened the summit by welcoming everyone and thanking them for joining. He said it was the 24th IBIS summit associated with IEEE SPI or other European conferences.

IBIS CHAIR'S REPORT

Randy Wolff (Micron Technology, USA)
(Start 00:03:10, Duration 19:00)

Randy Wolff gave an overview of the structure and activities of the IBIS Open Forum. He invited people to consider serving in officer roles, noting that a candidate for the Secretary office was still needed. Randy described each BIRD under consideration for IBIS 7.2, expected at about the end of the year. The future additions to IBIS might involve expanded support for inter-chip relationships such as clocking, timing, and equalization training, power integrity related improvements, and serdes operating at 112Gbps and beyond, for example. A Touchstone 3.0 specification was under consideration, possibly with pole-residue format and port naming. Randy said anyone could join a task group to participate or subscribe to relevant IBIS email lists, especially helpful where time zones were an issue. He showed where to find key information on the IBIS web pages.

Arpad Muranyi asked for details on future support for diode and inductor models for power integrity. Randy said Zhiping Yang had suggested that, but there were no details yet. Bob Ross said ESD diodes may require AMS modeling for “snapback”.

CIRCUIT SYNTHESIS OF MULTIPOINT NETWORKS FROM PASSIVE POLES AND RESIDUES

Chiu-Chih (George) Chou*, José Schutt-Aine**
(National Central University*, ROC; University of Illinois**, USA)
(Start 00:23:00, Duration 33:30)

José Schutt-Aine described a simulation method using model order reduction through vector fitting to reduce computation time. Part of the process was to enforce passivity. José described an equivalent circuit extraction process in detail. Tests had been performed up to 80 ports, which simulated in 255 seconds. Chiu-Chih (George) Chou reviewed six approaches for S-matrix representation in pole-residue form. Each approach had pros and cons. The sixth method was the most direct, but it would require simulator support for the Foster G element. Some methods required simulator support for negative RLC values. In tests, the sixth method had the shortest simulation times.

Looking at slide 15, Bob Ross asked if the vector fitting in method 1 could extract the equivalent circuit with additional sources for the case of asymmetrical structures, where y_{21} was not equal to y_{12} , and if that circuit would support recursive convolution. George said the Y model had only RLC elements, but such sources could be added.

FAST SIMULATION OF ANALOG CIRCUIT BLOCKS UNDER NONSTATIONARY OPERATING CONDITIONS VIA REDUCED ORDER EQUIVALENT CIRCUITS

Tommaso Bradde, Alessandro Zanco, Stefano Grivet-Talocia

(Politecnico di Torino, Italy)
(Start 00:57:10, Duration 32:50)

Tommaso Bradde gave an overview of methods to simulate component behavior, which could easily involve large circuits requiring significant time to simulate. Linearizing the models for small signal analysis could reduce model order, resulting in a 675x simulation performance improvement. Techniques for restoring the original bias points were evaluated. Dynamic small signal analysis could be used to track the operating point. Three model fitting approaches could be used, chosen based on the characteristics of the problem.

Chiu-Chih (George) Chou noted that with the parameterized LTI approach, complexity was exponential with the number of ports. Tommaso said once it was converted to a netlist, the number of ports did not matter. George also asked how they had realized a time-varying circuit. Tommaso said a controlled source element had an input port used to vary a parameter.

LOW-FREQUENCY MODAL EXTRAPOLATION AND REGULARIZATION FOR FULL-BANDWIDTH MACROMODELING OF ELECTROMAGNETIC STRUCTURES

Marco De Stefano*, Stefano Grivet-Talocia*, T. Wendt**, C. Yang*, Christian Schuster**
(Politecnico di Torino*, Italy; Hamburg University of Technology (TUHH)**, Germany)
(Start 01:30:20, Duration 24:45)

Marco De Stefano said they had investigated High Intensity Radiation Fields (HIRFs) and Electromagnetic Interference (EMI), which could harm devices. Diode grids could be used to protect against strong radiation, while allowing weaker signals to pass. That could be represented as a circuit. Macromodelling challenges included the lack of a DC point and a wide low frequency gap region, and approaches for resolving these were described. The data would be regularized to use the Method of Moments. Capacitive blocks were responsible for singularities. Tests of a 25-port system yielded very good accuracy. The result of the work was a system to fully automate simulation of systems with diode grids.

Chiu-Chih (George) Chou asked which simulation technique had been used for interconnect. Marco said the problem had been split into linear and non-linear portions, a waveform relaxation technique was used for the linear portion, and that provided inputs for the simulation. George also asked if the method could capture the DC point where capacitors and inductors were attached. Marco said small losses could be neglected but having a DC matrix was better.

K.T. WANG (WANG ALGEBRA) - EXPANDED HISTORY

Bob Ross (Teraspeed Labs, USA)
(Start 01:56:25, Duration 12:10)

Bob Ross said Dr. Cong Ling had contacted him about research on quaternions. Bob recalled the history of Ki-Tung Wang, inventor of the Wang Algebra for Loop Equations, including his family history. Wang was believed to be the first Chinese person to be published in an international journal. Wang Algebra was used for T-coil design.

Randy Wolff asked if Bob had discovered Wang while working on T-coils. Bob said that was the case.

BATHTUB EXTRAPOLATION OF IBIS-AMI TIMING JITTER

Longfei Bai (Dassault Systemes, Germany)

(Start 02:09:20, Duration 19:00)

Longfei Bai began by describing the operation of IBIS-AMI models, which support jitter analysis. A Dual-Dirac model could be used for bathtub curve extraction, with some conditions. In testing, the match against the theoretical flow was good. The range over which fitting was applied must be carefully chosen.

Arpad Muranyi asked if the choice of fitting range could be automated. Longfei said that would require more work. Randy Wolff asked if deterministic jitter could be estimated. Longfei said that could be done with an algorithm or possibly with AI, but it would be difficult.

IBIS POWER CURRENT PREDICTION WITH OVERCLOCKING

Aniello Viscardi*, Xuefeng Chen**

(Micron Technology*, Italy; Synopsys*, PRC)

(Start 02:28:20, Duration 36:25)

Aniello Viscardi described the use of rising and falling waveforms in classic IBIS buffer models, and the issue of overclocking. They had tested a model with 496 ps waveforms, reduced from the full length of 732 ps for the minimum corner, in a simulation with 277 ps UI. During simulation a new edge was triggered before the previous edge had completed. It was not possible to make the waveforms short enough to support 277 ps UI. The power current profile was inaccurate when overclocking occurred. A superposition technique could be used to remedy that by modifying the composite current waveforms. Accuracy of power currents was much improved, relative to the accuracy of EDA tools tested.

Arpad Muranyi asked if the superposition technique required no new data in the IBIS file. Aniello said that was the case. Arpad also asked about the cause of the remaining discrepancy between the new technique and transistor simulation results. Aniello said there were secondary effects with long bit patterns and power noise impacting IBIS simulations. For example, jitter of power noise was not modeled in IBIS. Aniello felt the method still had value, but improvements in IBIS were possible.

Lance Wang commented on slide 10, saying it appeared the current transition had just about completed when the second rising transition waveform began, noting that a test with more aggressive overclocking had resulted in a greater discrepancy relative to transistor simulation results. Aniello agreed that the method had that limitation.

POLE-RESIDUE IN TOUCHSTONE

Arpad Muranyi*, Bob Ross**

(Siemens EDA*, USA, Teraspeed Labs*, USA)

(Start 03:05:00, Duration 37:15)

Arpad Muranyi said the IBIS Interconnect Task Group had been discussing proposals under consideration for Touchstone 3.0, including the use of pole-residue format. He noted that the first presentation of the summit also highlighted the use of pole-residue format, which required a Foster G element for direct implementation. Arpad showed several proposed formats. Handling of duplicate poles was yet to be decided. The new format would support most of Touchstone 2.0, except for noise parameters. Arpad discussed several questions to be decided by the Interconnect Task Group. Regarding the first bullet on slide 10, Bob Ross said the philosophy was that files combining pole-residue and Touchstone 2.0 data should not be supported because the point of the pole-residue format was to produce smaller files. Bob also

said the Number_of_Poles subparameter on slide 5 did not correspond to the number of lines below it. Arpad said the subparameter was originally meant to indicate the number of lines, not the mathematically and theoretically correct number of poles. He felt a better name was needed for that subparameter. Arpad discussed the pros and cons of passivity checking in the Touchstone parser.

Stefano Grivet Talocia said passivity checking was easy, but causality checking could be problematic. Some uses of the data did not require causality, and he recommended not pursuing that check. He also recommended against allowing duplicate poles. Stefano also suggested supporting scaling factors in numeric representations. Bob agreed. Randy Wolff encouraged those interested in the subject to subscribe to the ibis-interconnect@freelists.org email reflector.

CLOSING REMARKS

(Start 03:42:50, Duration 1:00)

Randy Wolff thanked presenters and sponsors. He encouraged people to volunteer to help in the work of advancing the IBIS specification. He also hoped to see everyone in person in a future summit.

NEXT MEETING

The next IBIS Open Forum teleconference meeting would be held on June 3, 2022. The following IBIS Open Forum teleconference meeting was tentatively scheduled for June 24, 2022.

=====

NOTES

IBIS CHAIR: Randy Wolff (208) 363-1764

rwolff@micron.com

Principal Engineer, Silicon SI Group, Micron Technology, Inc.

8000 S. Federal Way

P.O. Box 6, Mail Stop: 01-720

Boise, ID 83707-0006

VICE CHAIR: Lance Wang (978) 633-3388

lance.wang@ibis.org

Solutions Architect, Zuken USA

238 Littleton Road, Suite 100

Westford, MA 01886

SECRETARY: Mike LaBonte

mike.labonte@ibis.org

TREASURER: Bob Ross (503) 246-8048

bob@teraspeedlabs.com

Engineer, Teraspeed Labs

10238 SW Lancaster Road

Portland, OR 97219

LIBRARIAN: Zhiping Yang (650) 214-0868

zhipingyang@google.com

Sr. Hardware Manager, Google LLC

1600 Amphitheatre Parkway
Mountain View, CA 94043

WEBMASTER: Steven Parker (845) 372-3294

sparker@marvell.com

Senior Staff Engineer, DSP, Marvell
2070 Route 52
Hopewell Junction, NY 12533-3507

POSTMASTER: Curtis Clark

curtis.clark@ansys.com

ANSYS, Inc.
150 Baker Ave Ext
Concord, MA 01742

This meeting was conducted in accordance with SAE ITC guidelines.

All inquiries may be sent to info@ibis.org. Examples of inquiries are:

- To obtain general information about IBIS.
- To ask specific questions for individual response.
- To subscribe to or unsubscribe from the official ibis@freelists.org and/or ibis-users@freelists.org email lists (formerly ibis@eda.org and ibis-users@eda.org):
 - <https://www.freelists.org/list/ibis>
 - <https://www.freelists.org/list/ibis-users>
- To subscribe to or unsubscribe from one of the task group email lists: ibis-macro@freelists.org, ibis-interconn@freelists.org, ibis-editorial@freelists.org, or ibis-quality@freelists.org:
 - <https://www.freelists.org/list/ibis-macro>
 - <https://www.freelists.org/list/ibis-interconn>
 - <https://www.freelists.org/list/ibis-editorial>
 - <https://www.freelists.org/list/ibis-quality>
- 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/bugspl.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>

Other trademarks, brands and names are the property of their respective owners.

SAE STANDARDS BALLOT VOTING STATUS

Organization	Interest Category	Standards Ballot Voting Status	April 8,	April 22,	May 13,	May 26,
			2022	2022	2022	2022
AMD (Xilinx)	Producer	Inactive	-	-	-	-
Analog Devices (Maxim Integrated)	Producer	Inactive	-	-	-	X
ANSYS	User	Active	X	X	X	-
Applied Simulation Technology	User	Inactive	-	-	-	-
Broadcom Ltd.	Producer	Inactive	-	-	-	X
Cadence Design Systems	User	Active	X	X	X	-
Celestica	User	Inactive	-	-	-	-
Cisco Systems	User	Inactive	-	-	-	-
Dassault Systemes	User	Inactive	-	-	-	X
Ericsson	Producer	Inactive	-	-	-	-
Google	User	Inactive	-	-	-	-
Huawei Technologies	Producer	Inactive	-	-	-	-
Infineon Technologies AG	Producer	Inactive	-	-	-	-
Instituto de Telecomunicações	User	Inactive	-	-	-	-
Intel Corp.	Producer	Active	X	X	X	-
Keysight Technologies	User	Active	X	X	X	-
Luminous Computing	General Interest	Inactive	-	-	-	-
Marvell	Producer	Active	-	X	X	-
MathWorks	User	Active	X	X	X	-
Micron Technology	Producer	Active	X	X	X	X
MST EMC Lab	User	Inactive	-	-	-	-
SerDesDesign.com	User	Inactive	X	-	-	-
Siemens EDA (Mentor)	User	Active	X	X	X	X
STMicroelectronics	Producer	Inactive	-	-	-	-
Synopsys	User	Active	X	X	X	-
Teraspeed Labs	General Interest	Active	X	X	X	X
Waymo	User	Active	-	X	X	-
ZTE Corp.	User	Inactive	-	-	-	-
Zuken	User	Active	X	X	X	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 (voting by email counts as attendance)

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.