IBIS Open Forum Minutes

Meeting Date: **April 21, 2023**
Meeting Location: **Teleconference**

VOTING MEMBERS AND 2023 PARTICIPANTS

Altair	(JuneSang Lee)
AMD (Xilinx)	(Bassam Mansour)
Analog Devices (Maxim Integrated)	(Don Greer)
Ansys	Curtis Clark*, Wei-hsing Huang
Applied Simulation Technology	(Fred Balistreri)
Aurora System	Dian Yang, Raj Raghuram
Broadcom	(Yunong Gan)
Cadence Design Systems	Kyle Lake*, Jared James, John Philips, Kristoffer Skytte
Celestica	(Sophia Feng)
Cisco Systems	(Stephen Scearce), Hong Wu
Dassault Systemes	Stefan Paret
GE Healthcare Technologies	(Balaji Sankarshanan)
Google	(Hanfeng Wang)
Honeywell	Bavish Vazhayil*
Huawei Technologies	(Hang (Paul) Yan)
Infineon Technologies AG	(Christian Sporrer)
Instituto de Telecomunicações	(Abdelgader Abdalla)
Intel Corporation	Chi-te Chen, Kinger Cai*, Michael Mirmak*, Hsinho Wu*
Keysight Technologies	Ming Yan, Douglas Burns, Fangyi Rao, Pegah Alavi, Hee-Soo Lee, Heidi Barnes
Marvell	Steven Parker
MathWorks	Graham Kus*, Walter Katz*, Kerry Schotz
Micron Technology	[Randy Wolff], Justin Butterfield, Akshay Shivaji Chaudhari, Dragos Dimitriu
MST EMC Lab	(Chulsoon Hwang), Zhiping Yang*, Cindy ?*
SerDesDesign.com	John Baprawski
Siemens EDA	Arpad Muranyi, Weston Beal*, Matthew Leslie, Mikael Stahlberg, Todd Westerhoff, Scott Wedge, Randy Wolff*
STMicroelectronics	(Olivier Bayet)
Synopsys	Ted Mido*, (Tushar Pandey)
Teraspeed Labs	Bob Ross*
Waymo	[Zhiping Yang], (Ji Zhang)
ZTE Corporation	(Shunlin Zhu)
Zuken	Michael Schäder
Zuken USA	Lance Wang

OTHER PARTICIPANTS IN 2023

Alphawave Semi	Adrien Auge, Todd Bermensolo
Ciena	Hugues Tournier
Honeywell	Bavish Vazhayil
Nokia	Ramiro Guzman
OMNIVISION	Sirius Tsang
Signal Edge Solutions	Ben Dannan
SI Guys	Donald Telian
Socionext, Inc.	Raymond Yakura
Unaffiliated	Will Hobbs, Mike LaBonte, Jon Powell, Stephen Peters, Zhiping Yang*

In the list above, attendees present 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# 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.

INTRODUCTIONS AND MEETING QUORUM

Randy Wolff reported that he is located at a ski resort in Idaho where snow is falling and would be moving to support an efficient meeting in order to ski as soon as the slopes opened. Those attending agreed to hold an efficient meeting.
Graham Kus declared that a quorum had been reached with 9 members attending, meeting the quorum minimum of 8.

CALL FOR PATENTS

Randy Wolff called for declaration of any patents or pending patents related to the IBIS, IBIS-ISS, ICM, or Touchstone 2.0 specifications. Patents were not declared.

REVIEW OF MINUTES AND ARS

Randy Wolff called for comments on the minutes of the March 31, 2023 IBIS Open Forum teleconferences. Zhiping Yang motioned to approve the minutes. Weston Beale seconded the motion. There were no objections. The motion passed.

The Minutes are available at the following link:
https://IBIS.org/minutes/

Randy Wolff reviewed ARs from the previous meeting.
ARs:

- Randy Wolff to provide link to SAE ITC press release covering IBIS 7.2 release [AR]
- No update.
- Randy Wolff to provide example of IEEE and SAE ITC dual logo standard [AR]
- No update.

ANNOUNCEMENTS, CALL FOR ADDITIONAL AGENDA ITEMS

Randy Wolff called for any announcements. Bob Ross reported that we have two affiliation changes, Zhiping Yang officially with MST and Randy officially with Siemens.

Randy discussed the proposed University Relations role as a potential future Board Officer position, and Zhiping may or may not have an update today's meeting. Zhiping shared that he did have an update for discussion later in the meeting.

Bob suggested this be a new item in the agenda.

Randy agreed on this topic as a new agenda item: Initial discussion of Officer Elections.

MEMBERSHIP STATUS AND TREASURER'S REPORT

Bob Ross reported that for 2023, we still have 30 members and a quorum of 8.

Currently we have 24 renewals and 2 new members (for a total of 26) for 2023.

Bob reported he is tracking 4 organizations for renewals.

We have been invoiced 2,000 euros (about $2,200) for a Silver sponsorship of SPI 2023 and the logistics for the European IBIS Summit.

$17,885 Balance for 2023
$22,935 Adjusted Balance for 2023 (Note, 2020 ZTE sponsorship moved forward to 2023)

WEBSITE ADMINISTRATION

Randy Wolff reported on behalf of Steven Parker that the Xilinx logo would be replaced by an AMD logo due to acquisition of Xilinx by AMD. Bob Ross confirmed he had provided the information to Steven.

MAILING LIST

Curtis Clark reported SiSoft.com domain has been retired. Graham Kus confirmed and would provide support for any necessary corrections to email User domains over to The MathWorks, Inc. email system since its acquisition of Signal Integrity Software, Inc.

LIBRARY UPDATE

Zhiping Yang reported on Return Loss being more important and we may want to consider this as it may affect IV curves. Is there any way we can model this or accommodate. Graham Kus suggested ERL (equivalent return loss) has been more prevalent recent standards than a s-parameter vs. frequency mask. Particularly with IEEE 802.3 working group, OIF-CEI 5.0, and USB4-V2 leveraging COM to now include ERL as a calculation. Randy Wollf clarified that this was to incorporate equalization for Tx and Rx. Graham agreed this was the case. Zhiping Yang asked for some references. Graham agreed to provide some of those citations.

INTERNATIONAL/EXTERNAL ACTIVITIES

Conferences:

Zhiping Yang reported that IEEE working group has been encouraging to have more local events. The idea is to promote connections locally and enable more participation. One of the main benefits was if there was any formal publication they would be uploaded. There was some speculation that in Silicon Valley, whether to collaborate on IBIS Summit in that regard, just bringing it up as a possibility.

SPI2023 – The 27th IEEE Workshop on Signal and Power Integrity (May 07-10, 2023, Aveiro, Portugal).

Link:
https://spi2023.av.it.pt/

IEEE EMC+SIPI conference scheduled for July 31 – August 4, 2023, in Grand Rapids, Michigan.

Zhiping Yang reported that a room has been reserved to host the IBIS Summit August 4, 2023, at the conference site. This will be a hybrid meeting supporting on-site and online attendees, with a Teams link provided at a later date.

Link:

https://emc2023.org/

Press Updates

Randy Wolff reported on 3 article links regarding IBIS by Analog Devices and hosted on their site discussing IBIS modelling.

Related Standards

Michael Mirmak reported regarding IEC 63055/IEEE 2401, JEITA "LPB," no updates as of the most recent meeting. The next meeting is May 4, 2023, where any update from LPB group would be shared then.

IEEE IBIS Standardization

Randy Wolff stated we were not sure if there would be able to move forward in any regard in the immediate term. He suggested it be put on pause or tabled for the immediate term. Zhiping Yang agreed.

IBIS Summits:

IEEE SPI 2023 IBIS Summit (May 7-10, 2023, Aveiro, Portugal):

At the Aveiro University of Telecommunications, Randy Wolff reported that he and Michael Mirmak would be attending starting at 2pm on that Wednesday, immediately following the luncheon following the SPI workshop. Still working on the agenda and it would be hybrid- so anyone in the US or other location would be able to provide a presentation remotely. He and Bob Ross had decided to be a Silver Sponsor for that on the event, which made it much simpler to deal with VAT, Room arrangements, and catering. This way SPI takes care of all planning for IBIS Open Forum. It also comes with a single registration for the conference which Randy will use and there would be some sponsorship funds provided by Siemens and Zuken. Bob Ross stated that we believe to have a count of 5 presentations planned to include by Michael Mirmak, Randy Wolff, Jose Schutinay(?), Weston Beale and others.

Randy stated IBIS is open to hosting additional presentations as well at this upcoming summit.

Link:

https://spi2023.av.it.pt/submissions/

QUALITY TASK GROUP

Bob Ross reported on the agenda is a Quality Specification, which we have been moving slowly on this with Weston Beal of Siemens and Michael Schäder of Zuken. Our main task has been reviewing results of IBISCHK 7.2.0.0. There is a test file which indicates some issues which had not been previously observed. We are deciding whether to proceed and file a bug report or to hold off and debug for the next release. We have not moved forward on a couple of other bugs relating to platform issues. There is another bug relating to root name, where our solution would cause what would be unstable. Those are items in discussion at present. Bob asked for any questions. There were none.

Note: The Quality task group checklist and other documentation can be found at:

http://www.IBIS.org/quality_wip/

ADVANCED TECHNOLOGY MODELING TASK GROUP

Randy Wolff reported on behalf of Arpad Muranyi that the meeting regularly meets Tuesdays at Noon Pacific Time US. The PSIJ BIRD is the current topic of discussion. Intel had with TS4 file with BIIS-AMI and introducing a 2nd port ordering option for s4p. that topic is close to being finalized.

Note: Task group material can be found at:

http://www.IBIS.org/macromodel_wip/

INTERCONNECT TASK GROUP

Michael Mirmak reported we continue to discuss changes to Touchstone. Instead of Touchstone 3, we are responding to request to support multiple impedance reference in pre-Touchstone 2.0 files. We are finalizing details to be sure exiting parsers would not be broken and still be able to distinguish between versions of Touchstone format. This would be provided to this group as to those details. Then proceed back to the topic of Touchstone 3.

Note: Task group material can be found at:

http://www.IBIS.org/interconnect_wip/

EDITORIAL TASK GROUP

Randy Wolff reported that this is suspended.

Note: Task group material can be found at:

http://www.IBIS.org/editorial_wip/

NEW ADMINISTRATIVE ISSUES

Randy Wolff reported on upcoming Officer Elections as follows. The elections are coming up. Officially date wise, the May 17th is the nomination period opens. That will run 2 weeks up to the end of May. Please consider whether you wish to be part of the IBIS board and volunteering. We will soon be reaching out to present and board members to ask about nominations. We do need a person to be the returning officer. Sending out email about voting and collecting votes. Anyone wishing to be the Returning Officer may reach out to Randy. Help is appreciated.

Randy asked if there were questions. None were asked.

New topic- University Relations

Zhiping Yang reported that he got a report from his colleague that after spring semester he could join the meeting. There is some activity from that research group, 2 presentations in recent summit 2020 and 2021 and 2022. They published 2 related publications at conference and transactions. There are a few in review process. In terms of research activity, his term is working on pre-driver delay simulation BIRD220 last October, and a paper will be submitted to IEEE-SIPI and he has been working on USB3.0 reference model, and hopefully can be published and to make a presentation to share with upcoming IEEE/IBIS summit. Also tried to train a neural network to construct and IBIS-AMI model. They will be meeting in person next

week with regard to a EMC lab IEEE meeting in Silicon Valley this year. It will be him and few professors, who to add more IBIS related research and hopefully students from this lab will have more knowledge on this topic and bring the knowledge to the industry.

Bob Ross stated that one of the goals of University Relations is to reach out to universities and one potential would be his affiliation with university of Florida. Irf there are other universities they can brought into the fold. It's not just most research topics but bring in other universities is my comment.

Zhiping agreed it was a good suggestion. There would be many professors at the IEEE conference and perhaps could piece together a group discussion of IBIS relating topics.

Randy Wollf asked Zhiping to discuss electronic datasheets. Zhiping shared we had a 1-hour discussion that IBIS is, and shared the Chair report from most recent DesignCon meeting. Some people know and others have zero knowledge. There were some good questions about what we are doing, but what I see is we really need our recognition in the industry especially around EDA tool support. It is easy to come up with standard but to really get EDA tool support is another challenge. For us the issue is chip vendor relations hip with EDA vendor- could be a great way to get the information into customer hands faster than by themselves. One question comment is that our standard keyword based is text format, is old fashions, they are working on.

JSON format. Is what they are using as a target format. It should not be difficult to translate to keyword format to JSON format. They can recommend leverage some content we have. Such as input Vinh and Vinl. Some information they are working on other. For example, they were talking about pin function description. We have a buffer model, but from IO buffer model, is not easy to tell if that is R2C data or R2C clock. The idea is they would like to have datasheet information populated in the models. Zhiping proposed to them to try to reuse much of what they have. Zhiping shared that some folks were from intel, which are IBIS members, and the forum members may wish to coordinate wit that other team at Intel to see if the effort can be combined or coordinated. This would be setup by email. Michael Mirmak agreed.

Randy Wolff shared a GitHub site at

https://www.github.com/edatasheets/edatasheets.github.io

File: ReadMe.md

There was group discussion about the content of Readme.md

Michael suggested that this group may not be aware of AMI, which structurally is similar to JSON and could be more directly translated. He also shared that the IEEE 2401 standard is more XML focused as opposed to JSON.

Zhiping stated that behavioral model is AMI, btu for them is more explicit. From them, it is more focused on datasheets, to enable machines to read datasheets. Whereas today, a person has to read datasheets and convert to EDA tool setup and simulations. Zhiping requested Michael send a link to IEEE 2401 standard.

If anyone has information or interested Zhiping would be happed to facilitate a connection, and they have biweekly meetings. Any overlap and pin principle they agree to collaborate rather than new standard.

Bob Ross asked, is JSON widely used or it narrow. Weston responded it is very widely used as XML in a similar way. Usually has a different program that is stored in XML or JSON format. It is note actually human readable (although it is text) but is meant to be parsed by a machine rather than by a human.

Bob asked if there could be translators between JSON and IBIS. That would enable both.

Weston stated his first opinion was there would be some overlap but not exactly unless the datasheet included all the behavioral that is in an ibis model that would be great.

There was group discussion on potential solutions to how a translator would work IBIS to JSON and IEEE and other topics relating to datasheet or system representation.

Randy asked if there were any other questions. There were none.

Roll call: Graham Kus reported a mid-meeting count of 14 attendees, with Cindy (?) from MST, Walter Katz from MathWorks, Michael and Kinger from Intel, and Bhavesh from Honeywell joining.

NEW AND REVISED *IRDS

None.

IRDS SCHEDULED FOR VOTE

None.

IRDS ELIGIBLE FOR VOTE

BIRD223: Add support for SPIM in IBIS (Cai et al)

Link: https://ibis.org/birds/bird223.docx

Arpad Muranyi reported

TABLED IRDS: (NO DISCUSSION WITHOUT MOTION TO "UNTABLE")

BIRD220: Pre-driver PSIJ Sensitivity Keyword (Ding et al)

Link:

https://IBIS.org/birds/bird220.docx

Arpad Muranyi reported

Walter Katz shared his opinion that there are other models for other power integrity analysis, and there are multiple ways of describing how power is described. He does not feel there should be an IBIS specification, but perhaps instead a SPIM specification representation and IBIS would reference that SPIM representation or timing models, for example. In our approach to this problem of having simulation models associated with components, we have a concept of a Part which has an IBIS file, Timing model, and other simulation models associated with that Part. So I would not put it into an IBIS model itself- some Parts are Transitions and things like that, which doe not even have IBIS models. Personally, I would have no objection with this specification but feel it should not be a BIRD but instead be a separate standards.

Kinger replied that in long term, we would like to have SI PI co-simulation. So right now most of IBIS is IO channel SI side. This is to extend IBIS to add in a piece of the PI side, in original scope, this BIRD had even larger scope- to have larger platform support in Frequency domain and the Timing domain. To have PI side to have AC and DC paths to have time domain

simulation to have noise. To say we also have PSIJ sensitivity. Eventually we have SI and PI stitch together, we are eventually supporting platform to support co-simulation.

Walter stated he agreed- to do a proper analysis as sucggest6ed, must have multiple models- one is IO buffer, one is specific to PI, another to Timing. All those models would be associated with a Component (which we call a Part). But those other models can be part of the IBIS standards. We and have another thing of IBIS standard. Not we have to have a mechanism to have this PI models associated with a SPI model or SPIM model. Whether we have this externally, we should have that be a separate specification for the PI part, but I son[t thing this would be a IBIS standard. It should be a PI standard. I don't mind if IBIS takes on PI and Timing analysis model, but I don't thin this this would be in an IBIS rile. IBIS is a IO buffer. Not how multiple buffers interact with each other. Ok? And all the other stuff that goes with. Is my comment.

Kinger responds, and other reason is to go with IBIS is that this is tarting to go with platform PI designed and to do syntax until IBIS umbrella for syntax and to follow the IBIS format really. Asked Zhiping to comment. One thing Zhiping shared is that this is our core designs. Meanwhile this standard organization.

There was additional discussion.

Bob Ross suggested we hold off any vote until some issues of fundamental structuring was resolved.

There was additional discussion by Cindy. We published a paper in the IEEE symposium. Would be submitted to IEEE SIPI transactions.

Zhiping asked, was not sure why the tables were added.

Randy clarified they were tabled because they can be separate but want that bird to be finalized before both could be read at the same time before making decisions if both can be voted on separating and all that.

IBISCHK AND TSCHK PARSER AND BUG STATUS

IBISCHK Parser:

Randy Wolff reported that there is a IBISCHK 7.2 Parser, but there is a bug where a particular rule on EMD files was not checked. We are debating to release the parser and file a bug report or hold off. Bob Ross commented, that is essentially what we are trying to decide. He had already confirmed with the developer they had checked out everything in the QA suite. Except this test from Micron relating to EMD file. Randy clarified we created a new rule for the designator pin list in EMD files, which creates a new signal type for no-connect (NC) which allows documentation of NC pins, by doing this as a signal type. The Parser now issues a warning. It ends up generating a list of warnings. Graham Kus proposed we ship the parser with an erratum that warnings be ignored. Bob clarified that a bug report would be the way to document this. There would be a better way to have a bug report test case. Bob suggested a possible way to move forward was to move forward as suggested, file a bug report, and perhaps deal with one other bug, and capture any other bugs along with this one. Weston reported there was another bug relating to this. Weston shared "not use NC as terminator on EMD model;" it issues a caution in this case and change it to an error. Because it specifically says in the specification that you cannot do that, and it and to do with the ZQ signal. In BIS that is an NC, but because the pkg model extracted that pin, it was assigned as a terminal on the EMD model. Randy stated there must be no terminal that defines an interconnect model.

Weston said the parser reports no an error but instead a caution- this specific is rare, but even if it does occur, will not create a problem for simulation. Randy highlighted the rule from IBIS 7.2 Specification,

“If a pin has a signal_type NC, then the designator pin and signal_name shall not appear on any of the terminal lines of any EMD Model.”

Bob shared we were not sure how much e debated this, we could see routing that is technically a no connect, we make it illegal but maybe it should be a caution. It could be you’re plugging in another part that is routing to that pin but is not in the simulation. So it would be seen as NC in simulation. Randy agreed we need a few bug reports and can classify how to resolve this. Bob shared due to European activities and other activities; we didn’t have time to deal with this without delaying Parser Development over a month. So we recommend (quality committee) recommend release parser as is, and deal with generating bug reports. We would probably mention 2 bug reports are planned against this release but not fully developed yet.

Randy asked if there was a motion. Graham moved to pass the parser. Michael seconded. No objections. Randy stated the motion passes.

Bob said part of the contract is part of the payment goes to the developer. We move forward to with what has been provided today. And a user guide what Weston provided. So, we now pay the developer.

Randy asked Bob to take an AR to move froward with Parser Developer payment (AR)

Bob shared that the source code has 32 and 64 windows and 32 and 64 Linux. The question here is do we want to support other architecture. Graham Kus stated that MathWorks supports Macintosh (Intel and Apple silicon) and would promote 64 bit support for that architecture moving forward. Weston clarified that we stop providing 32 bit for Windows and Linux. There was discussion to support Macintosh 64 bit executables. There was discussion to consider dropping 32 bit for future architecture.

Bob stated that in the future we would probably specify to drop 32 bit executables but would remain in the source code.

TSCHK Parser:

No updated was reported.

NEXT MEETING

Randy Wollf stated the next Open Forum meeting would be held on May 12, 2023 and that Lance Wang would probably conduct the meeting. Then we would agree at that time on a second meeting.

Michael Mirmak moved to adjourn. Graham Kus seconded. There were no objections. The meeting was adjourned.

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NOTES

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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: ibischk7, 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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SAE STANDARDS BALLOT VOTING STATUS (attendee X; absent -)

Organization	Interest Category	Standards Ballot Voting Status	Feb. 17, 2023	Mar. 10, 2023	Mar. 31, 2023	Apr. 21, 2023
Altair	User	Inactive	-	-	-	-
AMD (Xilinx)	Producer	Inactive	-	-	-	-
Analog Devices (Maxim Integrated)	Producer	Inactive	-	-	-	-
Ansys	User	Active	X	X	X	X
Applied Simulation Technology	User	Inactive	-	-	-	-
Aurora System	User	Inactive	-	-	-	-
Broadcom Ltd.	Producer	Inactive	-	-	-	-
Cadence Design Systems	User	Active	-	X	X	X
Celestica	User	Inactive	-	-	-	-
Cisco Systems	User	Inactive	-	-	-	-
Dassault Systemes	User	Inactive	-	-	-	-
GE Healthcare Technologies	User	Active	-	-	-	-
Google	User	Inactive	-	-	-	-
Honeywell	User	Active	-	-	-	X
Huawei Technologies	Producer	Inactive	-	-	-	-
Infineon Technologies AG	Producer	Inactive	-	-	-	-
Instituto de Telecomunicações	User	Inactive	-	-	-	-
Intel Corp.	Producer	Active	X	X	X	X
Keysight Technologies	User	Inactive	-	-	X	-
Marvell	Producer	Active	-	X	X	-
MathWorks	User	Active	X	X	X	X
Micron Technology	Producer	Active	X	X	X	-
MST EMC Lab	User	Inactive	-	-	-	X
SerDesDesign.com	User	Inactive	-	-	-	-
Siemens EDA	User	Active	X	X	X	X
STMicroelectronics	Producer	Inactive	-	-	-	-
Synopsys	User	Active	X	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

= Temporarily not a voting member

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.