



## IBIS Open Forum Minutes

Meeting Date: **November 13, 2020**

Meeting Location: **Online Virtual Summit**

### VOTING MEMBERS AND 2020 PARTICIPANTS

ANSYS	Curtis Clark, Wei-hsing Huang, Marko Marin Shai Sayfan-Altman, Zilwan Mahmod, Baolong Li Usman Saeed, Miyo Kawata*
Applied Simulation Technology	(Fred Balistreri)
Broadcom	James Church, Jim Antonellis
Cadence Design Systems	Zhen Mu, Ambrish Varma, Jared James Kumar Keshavan, Ken Willis, Suomin Cui Takuya Moriya*, Tadaaki Yoshimura*
Cisco Systems	Stephen Searce, Hong Wu, Han Gao
Dassault Systemes (CST)	Stefan Paret
Ericsson	[Anders Ekholm], Sungjoo Yu, Thomas Ahlstrom
Google	Zhiping Yang, Shuai Jin, Zhenxue Xu, Hanfeng Wang Songping Wu, Yimajian Yan
Huawei Technologies	(Hang (Paul) Yan)
IBM	[Michael Cohen], Greg Edlund
Infineon Technologies AG	(Christian Sporrer)
Instituto de Telecomunicações	(Abdelgader Abdalla)
Intel Corporation	Hsinho Wu, Michael Mirmak, Adrien Auge Fernando Mendoza, Taeyoung Kim, Wendem Beyene Oleg Mikulchenko, Nhan Phan, Ifiok Umoh Subas Bastola, Kingler Cai
Keysight Technologies	Radek Biernacki, Hee-Soo Lee, Todd Bermensolo Graham Riley, Pegah Alavi, Fangyi Rao Stephen Slater, Toshinori Kageura*, Hiroaki Sasaki* Satoshi Nakamizo*, Toshinobu Sanuki*
Marvell	Steve Parker, Johann Nittmann, Shaowu Huang
Maxim Integrated	Joe Engert, Charles Ganal, Dzung Tran, Yan Liang Tushar Pandey
Mentor, A Siemens Business	Arpad Muranyi, Raj Raghuram, Todd Westerhoff Weston Beal, Kunimoto Mashino*, Kenji Kushima*
Micron Technology	Randy Wolff*, Justin Butterfield, Larry Smith Vijay Kanagachalam
Micron Memory Japan, G.K.	Masayuki Honda*, Mikio Sugawara*
MST EMC Lab	Chulsoon Hwang, Anfeng Huang, Bo Pu, Jiayi He Yin Sun
NXP	John Burnett

SerDesDesign.com  
SiSoft (MathWorks)  
Synopsys  
Teraspeed Labs  
Xilinx  
ZTE Corporation  
Zuken

Zuken USA

John Baprawski  
Mike LaBonte\*, Walter Katz, Graham Kus  
Ted Mido\*, Andy Tai  
Bob Ross\*  
Ravindra Gali  
(Shunlin Zhu)  
Michael Schäder, Kazunari Koga, Kensuke Yoshijima\*  
Takayuki Shiratori\*  
Lance Wang\*

### **OTHER PARTICIPANTS IN 2020**

A&D Print Engineering Co.  
Abeism Corp.  
Accton  
Achronix Semiconductor  
AET  
Amazon Lab126  
AMD Japan  
Apollo Giken Co.  
Apple  
ARRL (IEEE EMC)  
Astrodesign  
ATE Service Corp.  
Aurora Innovation  
Aurora System  
Avnet K.K.  
Canon  
Canon Components  
Casio Computer Co.  
Christie Digital Systems  
Ciena  
Clarion Co.  
CMK Products Corp.  
Cybernet Systems Co.  
D-CLUE Technologies Co.  
De Montfort University (IEEE EMC)  
Denso Corp.  
Design Methodology Lab  
Eizo Corp.  
Exponential Failure Analysis  
Associates (IEEE EMC)  
ETS-Lindgren  
Facebook  
Forum Engineering

Ryu Murota\*  
Nobuyuki Kiyota\*  
Tariq Abou-Jeyab  
Hansel Dsilva  
Chihiro Ueda\*  
John Yan  
Tadashi Arai\*  
Satoshi Endo\*  
Jin Shi, Jun Xu  
Ed Hare  
Yoshiaki Nishi\*  
Yutaka Honda\*  
Jianming Li  
Hiroshi Ishikawa\*  
Shinya Ishizuka\*  
Soh Hoshi\*, Satoru Ishikawa\*, Shinichi Ohno\*  
Takeshi Nagata\*  
Yasuhisa Hayashi\*  
Mingchang Wang  
Kaisheng Hu\*  
Takatsugu Yasui\*  
Masaki Abe\*, Motoshi Nakamura\*  
Takayuki Tsuzura\*, Shiho Nagae\*, Akio Yanagi\*  
Kenzo Tan\*  
Alistair Duffy  
Hyounsong Che\*, Koji Ichikawa\*  
Motoh Tanaka\*  
Masaru Tamai\*  
  
Vignesh Rajamani  
Janet O'Neil  
Xin Chang  
Minoru Nakahara\*

Fuji Xerox Manufacturing Co. Fujitsu	Rumi Maeda* Kumiko Teramae*, Ikuo Ohtsuka*, Hirokazu Hidaka* Takashi Kobayashi*
Fujitsu Advanced Engineering Fujitsu Advanced Technologies Fujitsu Interconnect Technologies	Kazuhiro Kamegawa* Hideki Takauchi*, Magumi Nagata*, Yuji Sawa* Toru Kuraishi*, Masaki Kirinaka*, Akiko Tsukada* Manabu Fukuzawa*, Hiromi Kurokawa* Syunsuke Fujisawa*
Fujitsu Optical Components Furuno Electric Co.	Masaki Kunii* Naoaki Sasao*
Global Unichip Japan Hamamatsu Photonics K.K. Hitachi Hitachi Solutions Technology Hoei Co. Holor Technology Hoya Corp. IB Electronics Innotech Corp. Japan Radio Co. Jujube JVC Kenwood Corporation Kandou Bus KEI Systems Keyence Corporation Kioxia Corporation	Masafumi Mitsucshi*, Shingo Sakai* Hidetoshi Nakamura*, Ryouji Yamamoto* Kenichi Ishino* Sadahiro Nonoyama* Tatsuya Chiba* Kimihiro Ogawa* Masayuki Hagiwara* Makoo Matsumuro* Shinobu Seki* Hiroto Katakura*, Takashi Sato* Tajji Hosaka* Yasutoshi Ojima* Sherman Chen Shinichi Maeda* Takashi Moro* Yasuo Otsuka, Minori Yoshitomi*, Takayuki Mizogami* Masato Kanie*
Kioxia Systems Co.	Tomomichi Takahashi*, Yukio Tanoue*, Jyunya Shibasaki* Eiji Kozuka*
Konika Minolta Lemonade Social Media Megachips Corporation Meiko Electronics Co. Mitsuba Corp. Mitsubishi Electric Corp. Mitsubishi Electric Engineering Co. Modech Murata Manufacturing Co. NEC Platforms Nikon Corporation Nissan Motor Corp. Oki Electric Industry Co. OmniVision Panasonic Corporation	Takayuki Suzuki* Rachel Norrod Tomochika Kitamura*, Takahito Fukushima* Kiyoshi Baba* Dai Yanagisawa*, Yuko Kakubari* Yusuke Suzuki* Yasuhiro Segawa*, Minehiko Horii* Tadashi Aoki* Shigeaki Hashimoto* Yusuke Onodera* Manabu Matsumoto* Hidenari Nakashima* Atsushi Kitai*, Kenichi Saito* Sirius Tsang Kenkichi Hirano*, Shinichi Tanimoto*, Minori Harada*

Pioneer Corp.	Yuichi Tamura*
Privatech	Kazuo Ogasawara*
PWB Corp.	Toru Ohhisa*
Qualcomm	Kevin Roselle, Sunil Gupta, Yi Cao
Renesas Electronics Corp.	Genichi Tanaka*, Kazunori Yamada*, Masato Suzuki* Kazuyuki Sakata*
Ricoh Co.	Yasumasa Yamataki*, Miyoko Goto*, Toshihiko Makino* Kurose Koji*
Rion Co.	Katsuya Nakao*
RITA Electronics	Takahide Nozaki
Rockwell Automation	Meilin Wu
Rohm Co.	Noboru Takizawa*, Nobuya Sumiyoshi*
Ryosan Co.	Takahiro Sato*
SAE ITC	Jose Godoy
Samsung	Wonsuk Choi
San Jose State University	Vincent Tam
SAXA	Takayuki Ito*, Takayuki Sato*
Seagate	Preetesh Rathod, Alex Tain, Karthik Chandrasekar Emmanuel Atta
Seiko Epson Corp.	Shinichiro Kawano*, Toshiyuki Nishiyama*, Ryuichi Okada* Kenichiro Yajima*
Shimadzu Corp.	Kazuo Nakajima*
Shinko Electric Industries Co.	Takumi Ikeda*, Manabu Nakamura*
Signal Metrics	Ron Olisar
Silvaco Japan Co.	Yoshiharu Furui, Yoshihiko Yamamoto* Atsushi Hasegawa*, Yoshinori Kanno*
SK Hynix Memory Solutions	Jongchul Shin, Alex Lee, James Yu
Socionext	Matsumura Motoaki, Shinichiro Ikeda Takafumi Shimada, Hajime Ohmi*, Jyunko Nakamoto* Shizue Katoh*, Makoto Kumazawa*, Masatomo Ichioka* Fumiyo Kawatsuji*, Megumi Ohno*, Yukiko Tanaka* Yumiko Sugaya*, Osamu Ninomiya
Sohwa & Sophia Technologies	Tomoki Yamada*
Sony Global Manufacturing & Operations Corporation	Takashi Mizoroki*
Sony LSI Design	Toru Fujii*, Kazuki Murata*
SPISim	[Wei-hsing Huang]
Technopro Design Co.	Mai Fukuoka*
Tektronix Co.	Takafumi Watanabe*
Teradyne	Dongmei Han, Edward Pulscher, Sheri Zhuang Tomoo Tashiro, Paul Carlin, Tao Wang
TFF Tektronix Co.	Katsuhiko Suzuki*
Tokairika Co.	Furuna Yamamoto*
Tokyo Drawing	Naoya Iisaka*, Masahiko Nakamura*
Toshiba	Yasuki Torigoshi*

Toshiba Development & Engineering Corp.	Nobuyuki Kasai*
Toshiba Electronic Device Solutions Corp.	Youichi Sato*
Toshiba Electronic Devices & Storage Corp.	Yoshinori Fukuba*, Toshihiro Tsujimura* Atsushi Tomishima*, Takahiro Aoki*
Unaffiliated	Colin Brench
University of Florida	Shuo Wang
Unknown Affiliation	Y Ao*
XTUS	Sejin Pak*
Yamaha Corporation	Tetsuya Kakimoto*
Yazaki Parts Co.	Kenichi Fujisawa*

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 connection information for future IBIS teleconferences is as follows:

<https://tinyurl.com/IBISOFridayTeams>

### Join Microsoft Teams Meeting

Conference ID: 803 509 041#

[Local numbers](#) | [Learn more about Teams](#) | [Meeting options](#)

Join with a video conferencing device

[106010980@teams.bjn.vc](mailto:106010980@teams.bjn.vc) VTC Conference ID: 1143484747

[Alternate VTC dialing instructions](#)

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 – Japan took place on Friday, November 13, 2020 as an online virtual meeting. About 163 people representing 95 organizations attended.

The notes below capture some of the content and discussions. The meeting presentation slides, individual presentation video recordings, and full meeting video recording are available at:

<https://ibis.org/summits/nov20a/>

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

[https://ibis.org/summits/nov20a/summit\\_recording.mp4](https://ibis.org/summits/nov20a/summit_recording.mp4)

Takayuki Shiratori chaired the meeting and managed the online meeting platform. He opened the meeting by introducing attendees to the meeting platform and gave instructions on how to ask questions. (Start time: 4:45, End time: 11:45)

Randy Wolff opened the summit by welcoming everyone and thanking them for joining. He thanked the sponsors and JEITA for help organizing the meeting. (Start time: 12:00, End time: 13:30)

### **2020 ASIAN IBIS SUMMIT (TOKYO) MEETING WELCOMES**

Satoshi Nakamizo (Keysight Technologies Japan K.K., Japan) (Chair, JEITA EDA Model Specialty Committee)

Satoshi Nakamizo provided a meeting welcome to the attendees on behalf of JEITA.

(Start time: 16:15, End time: 19:00)

### **IBIS CHAIR'S REPORT**

Randy Wolff (Micron Technology, USA)

Randy Wolff provided a report on ongoing activities of the IBIS Open Forum.

(Start time: 19:00, End time: 30:30)

### **BRIEF REVIEW OF PDN IN IBIS**

Bob Ross (Teraspeed Labs, USA)

Bob Ross discussed power delivery network modeling in IBIS provided by various keywords.

Ted Mido asked what the advantages of the new model are proposed by the university compared to the previous models. Bob replied that the biggest difference is that it can handle pre-driver switching. For more information, please refer to the paper published by Missouri University of Science and Technology.

Masaki Kunii asked how we handle Touchstone data for power supply pins and power supply patterns in a PDN. Bob responded that IBIS-ISS can handle SPICE and S-parameters. How to handle them in simulation depends on EDA tools. Randy Wolff commented that we can represent any network with IBIS-ISS in IBIS, but what we haven't been able to include is the current of on-die power delivery. We would like to discuss how to express this in the future.

(Start time: 30:30, End time: 1:00:00)

## **THE ON DIE DECAP MODELING PROPOSAL (BIRD198.3)**

Megumi Ono\*, Atsushi Tomishima\*\* (\*Socionext, \*\*Toshiba Electronic Devices & Storage Corp.; Japan)

[Presented by Megumi Ono (Socionext, Japan)]

Megumi Ono reviewed BIRD198.3 and its capabilities for modeling on-die decoupling capacitance.

Randy Wolff asked Ono-san if she had any comments about her experience writing the BIRD and if there is anything IBIS can do to improve the BIRD process. Ono-san responded that although there is a time difference, we were able to have a lot of discussions via email and they were good for hearing what we missed, especially the comments and opinions from the EDA vendor's perspective.

Ted Mido asked if there are any difficulties or improvements in writing this BIRD. Ono-san responded she was glad to receive various comments and questions discussed in the IBIS ATM task group. Face-to-face discussions may have been difficult.

Bob Ross commented that on slide page 18, there is a little glitch on the AC analysis impedance curve. What is this glitch? Kazuyuki Sakata responded this glitch is a resonance due to the small capacitors and inductors on the package and chip. The model proposed today is an on die decap model, so there is no need to model and include these capacitors and inductors.

Tadashi Arai commented that he understands there are requests for chip vendors to create and provide models. However, modeling is difficult due to the large number of even simple I/O buffers. In addition, power aware IBIS modeling is more difficult. Initially, he thought chip vendors were refusing to provide models to protect their IP. However, this is incorrect, and the chip designer does not understand the modeling method correctly, so the model cannot be provided. Is there any good way to get a good understanding of the modeling procedure? Randy responded that we haven't updated the cookbook for a long time. There is some information in the IBIS specification, for example, how to create ISSO\_PU and ISSO\_PD data. There are also some software tools to help to extract power aware data when you create an IBIS model. There are a few commercial software options. We need to create some better training materials for that.

(Start time: 1:00:00, End time: 1:38:00)

## **BOARD DESIGN FOR LOW LOSS**

Shinichi Maeda (KEI Systems, Japan)

Shinichi Maeda presented a methodology for designing a low loss interconnect.

Shinichi Tanimoto said it was explained that the loss differs depending on the thickness of the copper foil. Does the loss change if the thickness is greater than the skin depth? Maeda-san responded that the skin depth should be considered not only above and below, but also

laterally. The surface area of the four sides changes depending on the thickness, and if it becomes thinner, the current from the side will decrease.

Taiji Hosaka said although not directly related to today's talk, please comment on the causality of the PCB due to dielectrics. Maeda-san responded that he thinks causality refers to the characteristics of S-parameters. Causality indicates the "roughness" of measuring or analyzing S-parameters. Looking at the phase of the S-parameters, if there are few measurement points, it may appear that the phase is reversed even though the amount of phase rotation is originally large. This is a causality problem. If the phase rotates smoothly, the causality problem will not occur.

Takayuki Mizogami asked what kind of design should be made in case of changes in line width or layer composition due to variations in PCB manufacturing when considering future signal speedups. Maeda-san responded that even if there is a slight deviation in the characteristic impedance, the loss and reflection are not so large. However, the accumulation of small deviations can have a significant impact. In the case of differential signals, skew occurs between pairs due to the difference in relative permittivity due to the glass cloth. If the wiring is long, skew will accumulate, which is a problem.

Mizogami-san asked if that means that the relative permittivity changes depending on the orientation of the glass cloth? Do you have information on what kind of wiring should be used? Maeda-san responded as you know, there is a method of chamfering at an angle to make the glass cloth uniform, but the manufacturing cost of the PCB will increase.

Hyounson Che commented that when performing SI simulations of PCB, the material properties (the relative permittivity and the dielectric loss tangent of the dielectric) use the values provided by the substrate manufacturer. However, these values make a difference between the actual measurement and the simulation result. Please tell me how to collect the relative permittivity and the dielectric loss tangent value of the dielectric when executing the SI simulation. Maeda-san responded that various data such as the surface roughness of copper foil, the shape of glass cloth and physical property values are required for accurate simulation, but it is difficult to obtain all the information. Also, because the design value and the manufacturing value are different, the simulation result and the actual measurement result may be different. In order to deal with these problems, it is common practice to create an evaluation board and obtain simulation input values to match actual measurements.

(Start time: 1:48:00, End time: 2:24:00)

## **TO OBTAIN HIGH ACCURACY OF IBIS-AMI CHANNEL SIMULATION**

Masaki Kirinaka, Akiko Tsukada (Fujitsu Interconnect Technologies, Japan)  
[Presented by Masaki Kirinaka (Fujitsu Interconnect Technologies, Japan)]

Masaki Kirinaka presented a study on the sensitivity of samples per bit (SPB) in IBIS-AMI to simulation accuracy.

Ted Mido commented that a large SPB value can represent jitter more accurately. However, each model has its own recommended value, so it is better to check it before using it.



Randy Wolff noted that it takes a long time to simulate using a large SPB value such as 1024. Are there any requirements for tools and algorithms from the perspective of the IBIS specifications?

Kirinaka-san said he has rarely considered chip jitter when running simulations. However, it became necessary to apply random jitter when running the simulation. Using the characteristic of Gaussian distribution when random jitter is applied correctly, we have now examined the effect of SPB values on simulation results. Normally, SPB values such as 32 and 64 are often used, but according to the results of this verification, it was necessary to use a large value such as 512. Increasing the SPB value will increase the time required for the simulation. He would like to hear your opinion on this.

Ted Mido commented that in this presentation, he understands that the reason why you had to use a large SPB value was because the period of random jitter applied was short. The chip vendor may have specified a random jitter value to apply when running the simulation. But whether random jitter is important in actual hardware design is another matter. Since the SPB value is used when calculating the equalization in the IBIS-AMI model, increasing the value to improve the accuracy will increase the simulation time. EDA vendors and IC vendors need to continue to work together to address short-period jitter.

(Start time: 2:24:15, End time: 2:58:30)

### **CLOSING REMARKS**

Bob Ross shared a picture of IBIS officers at a breakfast with JEITA officers before the DesignCon 2019 IBIS Summit meeting. He noted DesignCon is moved to April 2021. He hopes we can all get together sometime soon in the future.

Randy Wolff thanked the members of JEITA for help in organizing the meeting. He noted it is our first virtual summit experience, and it went well. Randy thanked Ted Mido for help with translations. He thanked the presenters and the participants. He hoped to meet everyone again in person in 2021.

(Start time: 3:02:45, End time: 3:07:15)

### **NEXT MEETING**

The Virtual IBIS Summit – China will be held on November 20, 2020.

The next IBIS Open Forum teleconference meeting will be held on December 4, 2020. The following teleconference meeting is tentatively scheduled for January 8, 2021.

=====

### **NOTES**

IBIS CHAIR: Randy Wolff (208) 363-1764

[rwolff@micron.com](mailto: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](mailto:lance.wang@ibis.org)  
Solutions Architect, Zuken USA  
238 Littleton Road, Suite 100  
Westford, MA 01886

SECRETARY: Curtis Clark  
[curtis.clark@ansys.com](mailto:curtis.clark@ansys.com)  
ANSYS, Inc.  
150 Baker Ave Ext  
Concord, MA 01742

TREASURER: Bob Ross (503) 246-8048  
[bob@teraspeedlabs.com](mailto:bob@teraspeedlabs.com)  
Engineer, Teraspeed Labs  
10238 SW Lancaster Road  
Portland, OR 97219

LIBRARIAN: Zhiping Yang (650) 214-0868  
[zhipingyang@google.com](mailto:zhipingyang@google.com)  
Sr. Hardware Manager, Google LLC  
1600 Amphitheatre Parkway  
Mountain View, CA 94043

WEBMASTER: Steven Parker (845) 372-3294  
[sparker@marvell.com](mailto:sparker@marvell.com)  
Senior Staff Engineer, DSP, Marvell  
2070 Route 52  
Hopewell Junction, NY 12533-3507

POSTMASTER: Mike LaBonte  
[mlabonte@sisoft.com](mailto:mlabonte@sisoft.com)  
IBIS-AMI Modeling Specialist, SiSoft  
1 Lakeside Campus Drive  
Natick, MA 01760

This meeting was conducted in accordance with SAE ITC guidelines.

All inquiries may be sent to [info@ibis.org](mailto:info@ibis.org). Examples of inquiries are:

- To obtain general information about IBIS.
- To ask specific questions for individual response.

- To subscribe to the official [ibis@freelists.org](mailto:ibis@freelists.org) and/or [ibis-users@freelists.org](mailto:ibis-users@freelists.org) email lists (formerly [ibis@eda.org](mailto:ibis@eda.org) and [ibis-users@eda.org](mailto:ibis-users@eda.org)).
- To subscribe to one of the task group email lists: [ibis-macro@freelists.org](mailto:ibis-macro@freelists.org), [ibis-interconn@freelists.org](mailto:ibis-interconn@freelists.org), or [ibis-quality@freelists.org](mailto: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](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	September	October	October	November
			18, 2020	09, 2020	30, 2020	13, 2020
ANSYS	User	Active	X	X	X	X
Applied Simulation Technology	User	Inactive	-	-	-	-
Broadcom Ltd.	Producer	Inactive	-	-	-	-
Cadence Design Systems	User	Active	X	X	X	X
Cisco Systems	User	Inactive	-	-	-	-
Dassault Systemes	User	Inactive	-	-	-	-
Ericsson	Producer	Inactive	-	-	-	-
Google	User	Active	X	X	X	-
Huawei Technologies	Producer	Inactive	-	-	-	-
Infineon Technologies AG	Producer	Inactive	-	-	-	-
Instituto de Telecomunicações	User	Inactive	-	-	-	-
IBM	Producer	Inactive	-	-	-	-
Intel Corp.	Producer	Active	X	X	X	-
Keysight Technologies	User	Active	X	X	X	X
Marvell	Producer	Active	X	-	X	-
Maxim Integrated	Producer	Inactive	-	-	X	-
Mentor, A Siemens Business	User	Active	X	X	X	X
Micron Technology	Producer	Active	X	X	X	X
MST EMC Lab	User	Inactive	-	-	-	-
NXP	Producer	Inactive	-	-	-	-
SerDesDesign.com	User	Inactive	-	-	-	-
SiSoft	User	Active	X	X	X	X
Synopsys	User	Active	X	X	X	X
Teraspeed Labs	General Interest	Active	X	X	X	X
Xilinx	Producer	Inactive	-	-	-	-
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

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.