25th Anniversary Panel Session: Past, Present and Future of ATS

Cheng-Wen Wu[1], Hideo Fujiwara[2], Xiaowei Li[3], Kuen-Jong Lee[4], and Seiji Kajihara[5]
[1]National Tsing Hua University, Hsinchu, Taiwan
[2]Osaka Gakuin University, Osaka, Japan
[3]Chinese Academy of Sciences, Beijing, China
[4]National Cheng Kung University, Tainan, Taiwan
[5]Kyushu Institute of Technology, Fukuoka, Japan

I. Introduction

Nine years ago, in the 16th ATS in Beijing, Prof. Tim Cheng organized a panel discussion session on test education [1], where they discussed the increasing demand for test and diagnosis expertise in the global semiconductor industry. They were worried about test education still being a niche and highly specialized subject area in the graduate curriculum and was seldom covered in undergraduate classes globally. It looks like we are not better off today, given even more severe competition and cost sensitive in the semiconductor industry. We are celebrating the 25th anniversary of ATS this year. Looking back the history of test research, obviously ATS has been an important part of it. Education wise, it also plays an important role, as we can see that the symposium rotates in different Asian cities where the semiconductor industry gains momentum and grows with ATS. The industry needs badly high-quality IC design, DFT, and test engineers, and professors bring students to ATS to get them ready for solving challenging issues that they will face immediately upon receiving their graduate degree. Can ATS serve the community in a similar way in the future?

There have been some panel sessions organized in the past 24 years for ATS, but most of them were dedicated to specific technical issues (see, e.g., [2-7]). This time, we are going to discuss how ATS will survive another 25 years. Or even more seriously, can it survive at all? To encourage the audience to join our discussion, we will give position statements on the past, present, and future of ATS. That is, we will review the past, which young attendees might not be familiar with. We will summarize the impact of ATS in different places in this region of the semiconductor world. We will analyze our position at the present time, and give visions of the future. We have observed the dramatic semiconductor market and industry shift in the past two decades, so it may be time for us to reposition ATS now.

II. Panelists

Table I lists the main participants of the panel session. Professor Cheng-Wen Wu is the organizer and moderator of the panel session. The panelists are Dr. Yervant Zorian, Prof. Hideo Fujiwara, Prof. Xiaowei Li, Prof. Kuen-Jong Lee, Prof. Seiji Kajihara, and Prof. Krishnendu Chakrabarty. All of them have involved in ATS in most part of its history, and have served in many important volunteer positions related to the organization of at least some of the ATSs.

III. Position Statements

In the panel, Dr. Zorian compares ATS with other TTTC events, and gives the outlook of the future of ATS. According to Prof. Fujiwara, the first ATS was held in Hiroshima, Japan in Nov. 1992. The preparation had begun two years earlier. He introduced the details of the process that lead to the foundation of the Asian Test Symposium (ATS). The purpose of ATS was to provide an opportunity for engineers and researchers from countries and territories around the world, but especially from Asia, to present and discuss state-of-the-art research and development in test and design technologies for electronic devices, assemblies, and systems. The first symposium in Hiroshima was a great success, which was followed by Beijing, Nara, Bangalore, Hsinchu, Akita, Singapore, Shanghai, Taipei, and Kyoto for the first ten years. The number of submitted papers and attendees had been growing, indicating the increasing popularity of design and test research in Asia. In the the tenth ATS in Kyoto, the tenth anniversary was celebrated, and the 10th Anniversary Compendium of Papers was published, giving strong foundation for the future development of the ATS.

According to Prof. Li, ATS has unique impact in mainland China. It has played an important role in China test community. In the panel he shows his personal, professional relationship with ATS, and the growth of his research team with ATS. Based on collected data and documents, he shows the growth of ATS in the 21st century, in comparison with China test conference and VTS, etc. He also analyzes two factors that could affect the future of ATS in China, and gives suggestions and solutions. He then gives an overview of opportunities and challenges in China test (research & development) community, and concludes with an outlook of the future of ATS in China.

Prof. Lee stresses that ATS is now the 3rd largest IEEE annual event dedicated to IC testing, attracting most EDA companies, test equipment suppliers, and many IC design houses. He summarizes the current status of ATS, and introduces Taiwan's current position in IC package/test industry, as well as the rich academic research activities in Taiwan, including VLSI Test Technology Forums, VLSI Test Technology Workshop, and Seminars on the Trend of Test Research/Development. Taiwan has been playing an important role in ATS in the past 25 years, and will continue to support ATS in the future. However, he raises some problems that should be addressed in order to have an even better ATS in the future, e.g., a declining number of new/young professors devoted to testing in recent years, and the industry interactions seem to be more from EDA companies.

According to Prof. Kajihara, ATS has been held in Japan eight times, nevertheless, the growth of the Japanese semiconductor industry has stopped since ATS started, while the entire Asian semiconductor industry has been growing drastically. Also, recent Japanese test research community seems to become less active. Its contribution level to ATS is getting lower and lower, though the quality of accepted ATS papers and discussions at the symposium has been improved tremendously. Of course there are still a good number of test researchers in academia to support future ATS in Japan, and

attractive places for ATS attendees to visit. He proposes that to develop ATS in Japan further, it is essential for Japanese test researchers to promote test research activities by 1) reinforcement of cooperation with the industry, 2) promotion of international joint research, and 3) being sensitive to new technologies such as IoT, big data, and AI. In addition to outlook, he also introduces key researchers in Japan who will possibly organize future ATS in Japan. Finally, Prof. Chakrabarty discusses the role and impact of ATS in the test community in general, and gives the outlook of the future of ATS in India.

REFERENCES

[1] K.-T. T. Cheng, "Test Education in the Global Economy", in *Proc. IEEE Asian Test Symposium (ATS)*, Beijing, Oct. 2007, p.53.

[2] C.-W. Wu, "Testing Embedded Memories: Is BIST The Ultimate Solution?", in *Proc. IEEE Asian Test Symposium (ATS)*, Singapore, Dec. 1998, pp.516-517.

[3] F. Muradali, "Practical Needs and Wants for Silicon Debug and Diagnosis", in *Proc. IEEE Asian Test Symposium (ATS)*, Fukuoka, Nov. 2006, p. 135.

[4] A. Uzzaman, "How to Increase the Effectiveness of Yield Diagnosis—Is DFM the Answer to This?", in *Proc. IEEE Asian Test Symposium (ATS)*, Sapporo, Nov. 2008, p. 135.

[5] S. Hamdioui, "Testing Embedded Memories in the Nano-Era: Will the Existing Approaches Survive?", in *Proc. IEEE Asian Test Symposium (ATS)*, Taichung, Dec. 2009, p. 339.

[6] I. Polian, "Testing Nanoelectronic Circuits under Massive Statistical Process Variations", in *Proc. IEEE Asian Test Symposium (ATS)*, Shanghai, Dec. 2010, p. xviii.

[7] X. Gu, "Is Component Interconnection Test Enough for Board or System Test", in *Proc. IEEE Asian Test Symposium (ATS)*, Niigata, Nov. 2012, p. 270.

Table I. Organizer and Panelists

	Cheng-Wen Wu National Tsing Hua University	He received the BSEE degree from National Taiwan University in 1981, and the MS and PhD degrees in ECE from UCSB in 1985 and 1987, respectively. Since 1988 he has been with the Department of EE, National Tsing Hua University (NTHU), Hsinchu, Taiwan, where he is currently a Distinguished Chair Professor. He has served in the past as the Chair of EE Department, Dean of EECS College, and Senior Vice President for Research. He also served at ITRI as the General Director of the SOC Technology Center (STC), and the Vice President and General Director of the Information and Communications Labs. He is a life member of the CIEE, a life member of Taiwan IC Design Society, and a Fellow of the IEEE.
	Yervant Zorian Synopsys	He received an MS degree in CE from USC, a PhD in EE from McGill University, and an MBA from Wharton School of Business, U-Penn. He is a Chief Architect and Fellow at Synopsys, and President of Synopsys Armenia. Formerly, he was with Virage Logic, LogicVision, and AT&T Bell Labs. He is currently the President of IEEE TTTC. He served on the Board of Governors of Computer Society and CEDA, was the Vice President of IEEE Computer Society, and the General Chair of the 50th Design Automation Conference (DAC).
	Hideo Fujiwara Osaka Gakuin University	He received the BE, ME, and PhD degrees in electronic engineering from Osaka University, Osaka, Japan, in 1969, 1971, and 1974, respectively. He was with Osaka University from 1974 to 1985, Meiji University from 1985 to 1993, Nara Institute of Science and Technology (NAIST) from 1993 to 2011, and presently is Professor Emeritus of NAIST and a Professor of Osaka Gakuin University. He has published over 400 papers in refereed journals and conferences, and nine books including the book from the MIT Press (1985) entitled "Logic Testing and Design for Testability." Dr. Fujiwara is a life fellow of the IEEE, a Golden Core member of the IEEE Computer Society, a life fellow of the IEICE and a fellow of the IPSJ.
	Xiaowei Li Chinese Academy of Sciences	He was born in 1964, and received his PhD in Computer Science from Chinese Academy of Sciences in 1991. He is Chair Professor of VLSI Testing and Fault-Tolerant Computing at Institute of Computing Technology, Chinese Academy of Sciences. He is an Executive Director of China National Key Lab of Computer Architecture. He served as Program Committee Co-Chair of ATS 2003 in Xi'an and General Co-Chair of ATS 2007 in Beijing. He served as Chair of ATS Steering Committee for the term from 2011 to 2013. He was Co-Founder of China Test Conference, and a Fellow of China Computer Federation.
	Kuen-Jong Lee National Cheng Kung University	He is a prof. in EE Dept. of National Cheng Kung University (NCKU), Taiwan. He received his BS, MS and PhD degrees from National Taiwan University (Taiwan), University of Iowa (USA), and University of Southern California (USA), respectively. He is the steering committee chair of ATS during 2014-2016. Previously he also served as the chair of Taiwan IC Design Association and the director of SOC Research Center of NCKU. His current research interests include test compression, SOC test/debug architectures, fault and defect diagnosis, and in-field autonomous testing. His invention broadcast scan methodology has been widely used in industry.
	Seiji Kajihara Kyushu Institute of Technology	He received the BS and MS degrees from Hiroshima University, and the PhD degree from Osaka University, Japan, in 1987, 1989, and 1992, respectively. Since 1996 he has been working in Kyushu Institute of Technology, where he is a Professor and dean of School of Computer Science and Systems Engineering. He received the Best Paper Award from IEEE WRTLT in 2007 and several awards from IEICE and IPSJ. For ATS, he has been involved in organizing the symposium since 1999; especially he served as a program chair in 2006, a general co-chair in 2008, and a steering committee chair in 2007~2010.
	Krishnendu Chakrabarty Duke University	He received the BT degree from the Indian Institute of Technology, Kharagpur, India in 1990, and the MS. and PhD degrees from the University of Michigan, Ann Arbor in 1992 and 1995, respectively, all in CS&E. He has been at Duke University since 1998, where he is a William H. Younger Distinguished Professor of Engineering in ECE Dept. He is a Fellow of ACM, a Fellow of IEEE, and a Golden Core Member of the IEEE Computer Society.