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**VLSI TECHNOLOGY AND CIRCUITS COMMITTEE  
DECEMBER, 2000 ADCOM REPORT**

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**TO:** IEEE EDS ADCOM  
**FROM:** H.-S. PHILIP WONG  
**SUBJECT:** ACTIVITIES OF THE VLSI TECHNOLOGY AND CIRCUITS COMMITTEE, JAN 2000 TO DEC 2000  
**DATE:** DECEMBER 8, 2000.  
**CC:** JAMES T. CLEMENS, ATSUSHI HORI, JACK LAU, ERIC M. MAIR, KEVIN J. O'CONNOR, DENNIS L. POLLA, WERNER WEBER, LALITA MANCHANDA, KEN-ICHI GOTO, SAVVAS CHAMBERLAIN, S.C. SUN, WILLY SANSEN, PIERRE WOERLEE, TSU-JAE KING, XING ZHOU

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**OVERVIEW**

The objective of the VLSI Circuits and Technology Committee is to identify new/hot areas of interest to the Electron Device and Solid-State Circuits communities. Based on the nature of the areas, we will recommend any or all of the following.

1. Initiate topical workshops of current interest (attached to existing conferences or start new ones)
2. Special Issues for major publications (e.g. T-ED)
3. Panel session topics for major conferences
4. Special Sessions for major conferences

This is the third year since the formation of this committee. Our previous success includes two workshops and one T-ED special issue.

As a result of our face-to-face meeting prior to the IEDM 1999, we determined that it is important to have an on-going activity to ensure the vitality of the committee. One-off type workshops are good to have when a special need arises, but such special needs do not happen on a regular basis.

During this year, much effort was spent on establishing an Emerging Technology Session within the IEDM. Details will be described in a later section. If successful, we believe this Emerging Technology Session will be the focal point of activity for this committee for many years to come, delivering value to EDS members by introducing members to new and emerging technologies through an establish forum.

This committee continues to operate entirely by email.

## MEMBERSHIP

In our previous report (Dec. 1999 report), we indicated that we will add enough members for the committee to function in 2001.

In choosing new members this year, we continue to execute on our desire to encompass members from Europe, Asia, as well as North America. The committee chair made a conscientious effort to include members with representations from different technical areas (technology and circuit), different geographic location, different gender, and different years of seniority in the business, as well as nature of the business (industry vs. academia). The slate of new members for 2000 includes elements of the above criterion.

We continue to expect to limit the membership of the committee to three years (by EDS rules, all members are appointed for one year with multiple renewable terms) so that new ideas can be incorporated. John Lowell resigned from the committee this year due to other engagement. All other committee members from 1999 were invited to serve for another year.

In 2001, both the present Chair and all the founding members will leave this committee, representing a complete turnover of membership in the committee since its founding.

The present members are listed below:

Term expired 1999 or retired	Term expiring 2000	Term expiring 2001	Term expiring 2002
Charlie Sodini, MIT (Chair, 1998)	H.-S. Philip Wong, IBM, (Chair)	Werner Weber, Infineon	Lalita Manchanda, Lucent
John Lowell, Oracle	Jim Clemens, formerly Lucent	Atsushi Hori, Matsushita	Ken-ichi Goto, Fujitsu
	Jack Lau, Hong Kong University of Science & Technology		Savvas Chamberlain, DALSA
	Eric Mair, National Semi.		S.C. Sun, Wafertech
	Dennis Polla, U. Minnesota		Willy Sansen, K. U. Leuven
	Kevin O'Connor, Lucent		Pierre Woerlee, Philips
			Tsu-Jae King, UC Berkeley
			Xing Zhou, Nanyang Technical University

## IEDM EMERGING TECHNOLOGY SESSION

During the face-to-face committee meeting prior to the IEDM 1999, Werner Weber made a proposal to foster discussions on Emerging Technologies at the IEDM. This proposal was fleshed out further in subsequent email among committee members during the first quarter of 2000. We considered hosting an Emerging Technology paper session, a tutorial tied to the IEDM, and a panel at the IEDM. After discussing the various ideas with the IEDM organizing committee, it was decided that a format that combines fact delivery and panel discussion is most attractive. Members of this committee produced several format options and many potential topics of discussions. Philip Wong was invited to attend the IEDM Executive Meeting in March, 2000, to formally present the proposals to the full IEDM committee. The proposal was received with great enthusiasm at the IEDM Executive Committee meeting, and the IEDM committee helped decide on the format. The VLSI

Technology and Circuits Committee was given the responsibility to find a suitable topic and to organize the panel session. An ad-hoc committee composed of a subset of the members were formed (members: Ken-ichi Goto (Fujitsu), Tsu-Jae King (UC Berkeley), Lalita Manchanda (Lucent), Werner Weber (Infineon), Pierre Woerlee (Philips), Philip Wong (IBM)). Many topics were considered and the ad-hoc committee eventually voted on the topics to be chosen for the inaugural session. Two topics were chosen: Single Electron Devices and Alternative Memory Technologies. Molecular devices and Carbon Nanotubes were a close second (with the Chair breaking the tie). The ad-hoc committee then proceeded to suggest panelists and speakers. The moderator (Pierre Woerlee) put together the final slate of panelists and speakers, invited the participants, and organized the session.

The process of fleshing out the emerging technology session idea involved a great number of members and represents a truly collaborative effort of this committee.

The description below summarizes this year's session, to be moderated by committee member Pierre Woerlee.

#### SCOPE OF THE PANEL

In order to provide IEDM attendees exposure to emerging device technologies that has a long time horizon, the IEDM introduces an evening session with a new format that combines fact-delivery together with opinion and idea exchange between the audience and the presenter. The intent of this session is both to provide solid, unbiased, background technical information, and to engage the audience in discussing the merits and potentials of nascent technologies. The session starts with a presentation of the background information, covering both the technical area and the research trends similar to an invited paper in a regular paper session. This is then followed by discussions among panel member(s) and the audience. This format, as compared to the traditional panel discussion format, provides more information and learning for the audience in addition to the environment to participate in an extended discussion.

#### PANEL TOPICS

This year's Emerging Technologies Session will discuss two topics: single electron transistors/devices and alternative memory technologies. The single electron transistor has been proposed both as a logic device and a memory element. It utilizes the Coulomb blockade effect and requires a small physical device dimension for operation above cryogenic temperatures. The advent of nanolithography and associated patterning techniques has raised the prospects of incorporating SET into a base CMOS technology. This session will start with an introduction to SET, summarizing its benefits and potential problems such as background charge, with a discussion of the current research trend. It will then be followed by discussions among panelist(s) and the speaker as well as the audience. The second half of this session will introduce alternative memory technologies. While conventional memory technologies such as the DRAM, SRAM, and floating-gate non-volatile memory will continue to scale to even smaller dimensions and higher density, recent development in alternative approaches may cover entirely different application spaces with different read/write speeds, retention, and endurance characteristics. Examples of these alternative

approaches include ferroelectric memory (FeRAM), magnetic tunnel junction memory (MagRAM), single electron memory, nano-crystal floating gate memory and so on. This session will start with an overview of these alternative memory technologies, describing their operating principles and application space. It is then followed by discussions with a panel of experts on these technologies, with participation from the audience.

### **Invited speakers + panel**

Moderator: Pierre Woerlee (Philips research labs)

Invited Speakers:

SET (logic and memory): Prof. J.E. (Hans) Mooij (Tech. University Delft)

Alternative Memory: Bill Reohr (IBM)

Panel:

SET, NVM Sandip Tiwari (Cornell University)

DRAM, MRAM, FERAM Erwin Hammerl (Infineon)

FERAM Tatsuya Yamazaki (Fujitsu)

Flash Koji Sakui (Toshiba)

MRAM (dev. + Material) Stuart Parkin (IBM)

### **Proposed Programme:**

1. Introduction 5 minutes (topics, panel members) - Panel moderator
2. Single Electron Devices (30 minutes) - Prof. J.E. (Hans) Mooij
3. Discussion Panel + audience (30 minutes)
4. Alternative Memory Technologies (30 minutes) Bill Reohr  
(Focus on MRAM and FERAM)
5. Discussion Panel + audience
6. Wrap Up - Panel moderator

### **EDS WEBSITE**

Xing Zhou created a website for this committee. At present, the website is hosted out of Dr. Zhou's affiliated institution, with a pointer from the EDS website. The website describes our committee's activities and should be a good forum to disseminate information to EDS members. The URL link can be found in the EDS homepage under EDS Technical Committees and Other Technically Related Groups, URL: <http://www.ieee.org/organizations/society/eds/groups.html>, and EDS Roster <http://www.ieee.org/organizations/society/eds/roster.html>

### **TRANS. ELECTRON DEVICES SPECIAL ISSUE**

The Transactions on Electron Devices Special Issue on Computational Electronics: New Challenges and New Directions was published in the October issue of T-ED. This special issue was fermented by a proposal from the VLSI Technology and Circuits Committee in 1999.