Vol. 50, No. 4 January 2001

IEEE Cleveland Contact

Publication of the Cleveland Section of the Institute of Electrical and Electronics Engineers.

Microwave Applications of Ferroelectric Films

IEEE Topical Workshop • March 19-20, 2001

Sponsored by *: NASA Glenn Research Center • Ohio Aerospace Institute • Cleveland MiREA and MTT Chapters of IEEE*

www.oai.org/OAI/events/IEEE.html

You are invited to participate in a two-day workshop on advances in microwave applications of ferroelectric materials, located at the Ohio Aerospace Institute, 22800 Cedar Point Road, Cleveland, Ohio, 44142. Attendance is limited so please respond early.

Objective and Scope

The NASA Glenn Research Center has helped pioneer the development of ferroelectric microwave technology. Interest was stoked by the need for efficient and low cost scanning phased array antennas and other "smart" electromagnetic structures. Not only have effective devices and circuits been demonstrated, they have significantly outperformed their semiconductor counterparts and in some cases enabled entirely new functionality. This focused workshop will consolidate recent theoretical and experimental efforts, strictly associated with microwave devices and circuits based on thin ferroelectric films, for communications and sensor applications.

There are still disconnects between the device designer and the materials scientist that need to be addressed. For example, there is still much debate surrounding the relationship between crystal properties and device performance. Considerable effort has been expended trying to control electrode/ferroelectric interface effects and understanding the effects of strain on loss and tuning. Among designers there are competing approaches such as parallel plate varactors and coplanar or coupled line structures to combat these various effects. And there are still significant differences between theoretical expectations and actual performance of thin films suggesting fundamental shortcomings of our knowledge. A key aspect of the workshop will be two half-day seminars on dielectric response and losses, as well as device implementation, at microwave frequencies by distinguished lecturers. Then, invited presentations will further examine material loss and tuning mechanisms, novel devices and circuits, and testing advances. The workshop will also feature potential technology users from industry. Barriers to commercialization and "killer" applications will be discussed. The goal is to help catapult the technology into the marketplace given our current and anticipated grasp of the physics and material. A tour of the NASA facilities will be provided.

Continued on page 4

The Real Measure of CPU Power

By Steve Belovich

"How powerful is my computer?" This question is asked by nearly everyone at least once. Computer makers' sales and marketing efforts have emphasized this issue above all others in order to promote their individual machines. Usually, the answer to this question is given in terms of MHz, MIPS, MFLOPS or SPECMarks. Unfortunately, the real answer to this question depends upon many factors. Further, these figures are often very misleading and may be poor guides for selecting a computer.

What are MIPS?

Most people know that MIPS stands for "Millions of Instructions Per Second". What is less well-known is that this figure is a statistical average which is based upon test results from several programs. To measure the MIPS of a given machine, a group of programs is selected which are deemed "representative" of the "typical program" that a "typical user" will run. The total number of machine instructions in these programs (including loops, BIOS calls, etc.) is counted. The programs are then run on the machine and the total elapsed time

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IEEE Cleveland Section CHAIRMAN'S COLUMN

by Carl Dister

CLEVELAND WORKS! This will be my mission statement for the Cleveland Section over the upcoming year. I believe that it is the responsibility of our section to help Electrical Engineers and Electrical Engineering students who live and work in this area to find and keep jobs. This is difficult in an area that is undergoing tremendous change: companies downsizing and moving out of the area; new technology areas emerging; technology in general moving at an increasingly rapid pace.

This year I plan to address the following topics with your help:

1. Are the Cleveland universities providing the skills needed for those engineers and students who would like to stay in Cleveland?

2. Does the training from the universities, and IEEE in our area, match the skill sets needed to keep working in Cleveland?

3. Does the Section understand the area's demographics and how that will change/grow over the next few years?

4. Do the activities of the Section (Chapter meetings, PACE training,...) match the needs of the Cleveland area?

My goal as Chairman this year is to make available to Cleveland Section members a report on the topics listed above. Also, I hope this report will be of interest to the local universities, as well as local government.

Of course, there is other important work that needs to be done in the section, but much of that work could be easily misdirected if there is no a clear vision of the membership and its needs in our area.

Thank you for choosing me as your new Chairman, and I look forward to a great year!

The Joint Societies Chapter: Engineering in Medicine & Biology, Signal Processing, Computer and Nuclear and Plasma Science Cleveland Biomedical Imaging Group Held First Meeting

By Ray Muzic and Zhenghong Lee

The inaugural meeting was a success by all accounts. Turnout (17) was good, many good ideas were proposed, and people expressed realistic expectations. The main points are summarized below. Please note that in Points 5, 6, and 8 we request a response. However, comments on all points are welcome!

1. The informal name of the group will be Cleveland Biomedical Imaging Group (CBIG). (The official name is Cleveland Section Joint Societies Chapter of Engineering in Medicine and Biology, Signal Processing, Computer, and Nuclear and Plasma Sciences.)

2. People would like the group to provide opportunities
a) to foster academic-industry communication
b) to learn about modalities different than their areas of expertise
c) to improve the visibility of Cleveland as a "medical imaging town"
d) to provide opportunities for students and industry to meet to discuss job opportunities
e) to benefit from the lectures from the Distinguished Lecturers' Program

3. The group supported making the "acting" officers' appointments permanent for the first year, with the vice chair from one year becoming the chair the next year for continuity. These people are Chair: Raymond F. Muzic, Jr., Nuclear Medicine, Univ. Hospitals Cleveland; Vice Chair: David Dean, Neurological Surgery, Case Western Reserve University; Treasurer to be named, possibly from Marconi; Secretary: Zhenghong Lee, Nuclear Medicine, Univ. Hospitals Cleveland.

4. We intend to have about six meetings per year. The standard meeting format will include a technical lecture, lasting approximately an hour. One or two meetings could be lecture/tour format. We intend to bring in at least one distinguished lecturer per year. Meetings will be proceeded by CBIG business as needed and social time as desired.

5. We seek volunteers to present in one of the above formats. Please send name, topic, lecture duration and brief summary to muzic@ieee.org.

6. By nomination, please indicate what Distinguished Lecturer Program (DLP) speaker you would like to hear.

7. Location of future meetings has yet to be decided. Holding them closer to CWRU will encourage student attendance. Meeting start times of 4 or 5 PM were suggested. We intend to have our next meeting in early/mid January of 2001. Watch the IEEE website for further information.

8. We would like to establish a Steering Committee. All those who attended the first meeting are welcome to join it. The main activities will be to provide input for speaker selection; much of this will be done via email. If you would like to join and want to participate in the email discussions, please send email to Ray Muzic (muzic@ieee.org).

9. There was general support for development of a website to be used for meeting announcements, maps to meetings, slides from lectures, etc. Development can be started now, but full-fledged effort could be postponed until promise is shown that interest in CBIG will be sustained. Also, effort should be focused not on bells and whistles but rather on low maintenance. Al Di Rienzo suggested that someone from Marconi could help with web. Via post-meeting email to Ray Muzic, Joe Collura (jcollura@mail.jcu.edu from John Carroll) indicated his interest in being the webmaster.

10. If you know someone who would like to be added to the CBIG email list, please ask him to send email to Ray Muzic (muzic@ieee.org).

Who Is the Inventor? What Does He Get?

By Michael Garvey

Everybody is an inventor. We all come up with creative solutions to problems we encounter. We are, perhaps, proud of our creation and may even get some form of recognition: a pat on the back or even a bonus.

The grant of a patent confers a special form of recognition on an inventor. In the U.S., patents are issued in the name of the inventor or coinventors, even if they are owned by a corporation. But most patents are awarded for inventions made by employees simply doing their jobs. Thus, the inventor usually does not own the patent. The reward for inventing is the honor of being named on the patent and possibly a nominal cash award.

The inventor is the person who conceived the invention that is covered by the claims of the patent. "Conception" is something more than an idea, but need not include every detail required to make the invention work. A technician who builds the invention by selecting particular components suitable for realizing the concept normally is not considered an inventor.

Coinventors can contribute to the entire invention in a sort of group conception or they may contribute different parts of the invention. In fact, coinventors need not work together.

Because there is some honor and potentially some monetary reward for being named an inventor, there is sometimes a temptation to include managers who supervised the inventive process, but did not contribute to conception. Sometimes, salesmen who ask for a solution to a problem but do not conceive the solution want to be named as inventors. The real inventors might not object because they must transfer the rights to their employer and, therefore, lose nothing by adding other names to the list of inventors.

Normally naming incorrect inventors is a situation that can be corrected if there was no deceptive intent. In some cases, however, naming incorrect inventors can be fatal to a patent.

Inventorship involves other concerns too. When individuals or employees of different companies are involved in creating an invention, the identities of the inventors can become more significant than just the pride of the inventors.

Each inventor is entitled to practice the invention. More importantly, each inventor is entitled to sell or license his or her rights in the patent without accounting to the other inventors. This means that one inventor could license the patent in exchange for royalty payments. This inventor could keep all of the payments to herself and the other inventors would get nothing.

Often, an independent contractor is hired to solve a problem. While solving the problem, the contractor may create a patentable invention. Without an agreement specifying the ownership rights in any inventions, the contractor will probably own the rights in the patent. The contractor could then license the invention to anyone, including competitors of the company that hired the contractor.

Thus, a company should make an agreement with anyone who might create a patentable invention for the company. The agreement should specify who owns any patents and what rights each party has in the invention. Again, the inventor will be named on the patent, but the agreement can require the inventor to transfer ownership of any patents.

Naming the inventors on a patent should not be taken lightly, because the validity of the patent is at stake. Agreements about ownership of inventions should be put in place with employees, contractors, and other companies involved in projects that might result in patents.

Michael Garvey is a patent attorney with Pearne & Gordon LLP.

Attention IEEE Cleveland Section Members

The "Contact" editors make every effort to have your newsletter on the website at the start of each publication month. However, we cannot do this without your help.

All articles, meeting announcements, advertisements, etc., must be e-mailed to us by the 20th of the preceding month. Please send all submissions to Mgreene828@aol.com. We reserve the right to edit for space considerations.

Thank you all for your assistance! We cannot publish without all of you!

Microwave Applications of Ferroelectric Films • IEEE Topical Workshop • March 19-20, 2001

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Agenda

March 19, 2001

8:00-8:30	Registration (at OAI)
8:30-8:40	Welcome
8:40-8:50	Introduction: Dr. Robert Romanofsky
9:00-12:00	***Lecture 1 - "Dielectric Response and Losses of Ferroelectrics at Microwave Frequencies",*** Dr. Svetlana P. Zubko, Electrotechnical University, St. Petersburg, Russia.
12:00-1:00	Lunch On-Site
1:15 -2:45	NASA Glenn Research Ctr. Tour
3:00-5:00	Invited Talks
5:00	Evening Social
6:00	Dinner

March 20, 2001

8:30-11:30	***Lecture 2 - "Microwave Devices Based on Ferroelectric Materials",*** Dr. Orest Vendik, Electrotechnical University, St. Petersburg, Russia.
11:45-12:45	On-Site Lunch
1:00-3:00	Invited Talks
3:15-5:00	Panel Discussion
5:00	Wrap-Up - Dr. Felix Miranda

Accommodations and Transportation

Attendees are responsible for making their own arrangements for overnight accommodations. A block of rooms has been reserved at the Hampton Inn, 25105 Country Club Blvd, North Olmsted, OH 440-734-4477, until March 1, 2001, at a special conference rate of $70.00 plus tax. Please refer to reference code #IEEE. Hampton Inn Shuttle service is available from the Airport to the hotel by calling the above number. It will also be available from the Hampton Inn to OAI.

Registration & Fee Information

In order to streamline your arrival, we ask that you pre-register on line at: http://www.oai.org/events.html. Early registration fee is $110.00 until March 1, 2001, $150.00 after March 1st. There will be no on-site registrations. The fee covers workshop course instruction March 19-20, 2001, continental breakfast and lunch (March 19-20), breaks, and a dinner evening function on March 19th, as well as course handouts. Please make checks payable to "OAI" and mail to the OAI address below. For VISA and MasterCard payments please call Kim Romanofsky at 440-962-3023. Cancellations must be made by COB on March 16th, 2001, to receive credit, either by e-mail to KimRomanofsky@oai.org or by phone 440-962-3023.

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Travel Directions:

Traveling WEST on I-480, take the 6A exit onto Ohio Route 252 South. The first left is Butternut Ridge Road, turn left. At the first stop sign, turn left onto Columbia Road. Take Cedar Point Road about 1 mile to OAI on the left, just before the NASA west entrance.

Traveling EAST on I-480, take the 6A exit onto Ohio Route 252 South. Turn right at the exit light.The first light is Butternut Ridge Road, turn left. Turn left at the first stop sign onto Columbia Road. At the first traffic light, turn right onto Cedar Point about 1 mile to OAI on the left, just before the NASA west entrance.

Also check the workshop web site for more directions: www.oai.org/OAI/events/IEEE.html

The Real Measure of CPU Power *Continued from page 1*

needed to execute them is measured. The total number of instructions is then divided by the elapsed time to get the MIPS rating.

Clearly, the MIPS rating depends heavily on the particular programs selected, the compiler and even the operating system. Selecting a different program mix will also change the MIPS rating, often by a factor of two or more.

Using different optimizations during compilation (or different compilers) can drastically change the distribution of machine instructions, particularly with regards to the emulation of floating-point operations. This effect can even cause the MIPS rating to vary inversely with CPU performance!

When the VAX 11/780 was introduced by DEC in 1977, benchmark tests indicated that it was about as fast as an IBM 370/158. Since IBM's marketing referred to the 370/158 as a "1-MIPS" computer, DEC's marketing called the 11/780 a 1-MIPS machine. The 11/780 was so popular that nearly all manufacturer's gave MIPS ratings for their machines that were relative to a VAX 11/780. Thus, if a machine was 10 times faster than a VAX 11/80, it was called a 10-MIPS computer. Reality set in during the early 1980s when Joe Emer from DEC actually measured VAX 11/780 performance and discovered that it was barely 0.51 MIPS. Since then DEC has used the VUP (VAX Unit of Performance) to indicate speed relative to a VAX 11/780.

What are MFLOPS?

MFLOPS stands for "Millions of Floating-point Operations Per Second". It is measured in a similar way as MIPS, i.e., using a "typical" program mix. Since the set of floating-point (FP) instructions varies across computers, (e.g., a Cray-2 has no divide instruction whereas the Motorola 68882 has divide, square root, cosine and sine instructions), "normalized" MFLOPS are often used. The table below shows the normalized FP operations used by the authors of the "Livermore Loops" benchmark programs.

Table 1: "Livermore Loops" Normalized FP Operations

Real FP Operations	Normalized FP Operations
Add, Compare, Multiply, Subtract	**1**
Divide, Square Root	**4**
Cosine, Exponent, Sine, etc.	**8**

Like MIPS, MFLOPS depends upon the program mix and compiler optimizations and so is subject to the same errors and misinterpretations.

What are SPECMarks?

The computer industry has recognized the limitations of MIPS and MFLOPS in evaluating CPU power. In 1989, the System Performance Evaluation Cooperative (SPEC) released a set of benchmark programs to measure CPU speed. These are real programs which are intended to be representative of real workloads and are selected to measure both floating-point and integer performance (SPECf and SPECint). The SPECmark figures are computed based upon the execution times of the individual programs. The SPEC benchmark suite has been widely accepted, but it still should be used with caution since it may not reflect the actual workload.

Things to Look Out For

Peak performance has little to do with actual performance. The so-called "Perfect Benchmarks" (designed by the "Perfect Club", a consortium of universities and companies interested in parallel computation) were run on a CRAY X-MP/416, an IBM 3090-600S and a NEC SX/2 by Lubeck, Moore and Mendez [1985]. In each case, the actual MFLOP performance of the Perfect Benchmarks (summarized via the harmonic mean) was barely 1% of the manufacturer's claimed peak performance.

Another trap for the unwary is confusing clock speed with performance. Between CPUs from the same family, higher clock speeds generally mean faster machines. However, increasing the clock speed from 33mhz to 100 Mhz will not triple the overall performance. The number of clock cycles per instruction for portions of the instruction set usually must be increased in order to achieve higher clock speeds. More clock cycles are thus required to execute a given instruction which can negate a significant portion of the clock speed improvement. This effect can be seen in the PC market where program execution times have not decreased in proportion to clock speed increases.

So How Do I Measure Performance?

The short answer is that you can't - there is no single metric which is universally applicable in all situations. A good rule-of-thumb is use to interpret the SPECmarks (or other real-program benchmarks) in terms of your specific workload. If your main application is compilation, then emphasize compiler performance measurements. If your application is numeric analysis, then emphasize floating-point and vector performance. In all cases, use common sense and don't be fooled by the marketing hype.

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Please note: if you are trying to contact the IEEE Cleveland Section by FAX, dial 440-473-6557. The line is open twenty-four hours per day.

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Cleveland Contact
Publication of the Cleveland Section of the Institute of Electrical and Electronics Engineers.

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The "Contact" is published eight times per year: September, October, November, January, February, March, April and May. The deadline for electronic Newsletter articles is the 20th of the previous month.