VIRGINIA MOUNTAIN SECTION
NEWSLETTER

IEEE Region 3, Council 09, Section 65 February 2007

Thursday, February 15, Clarion Hotel Roanoke Airport

Student Paper Contest

Presentation of Papers by Undergraduate Students From VMI and Virginia Tech on

Electrons, Holes, and the Hall Effect
Emergency Underground Communication Using Seismic Waves
Design and Layout of a Nanosensor Array and Readout Circuit
Framework for Design, Verification and Analysis of System C

Date: Thursday February 15, 2007
Social: 6:15 PM
Dinner: 6:45 PM
Talks: 7:45 PM
Cost: Member or Guest $15.00
Student $ 8.00

Reserve by **5 PM Monday Feb. 12**
Dr. Wilbur Dale (540) 464-7547
mail to:dalewn@vmi.edu
Please specify number of attendees.

Directions to
Clarion Hotel Roanoke Airport
2727 Ferndale Drive NW
I581 Exit 3 Hershberger Rd West
1st Rt. onto Ordway Drive,
¼ mile, Rt. Into Parking Lot.

Electrons, Holes, and the Hall Effect
Isaac Putnam, VMI

This research project was designed to become a classroom example to help students understand the Hall Effect. From their experience in chemistry, physics, and electrical circuits classes, students have a firm grasp of the electron as a particle. However, the concept of an electron vacancy, or "hole," in the valance energy band of a semiconductor crystal behaving as a positive charge with mass seems metaphysical to them. To demonstrate this, a Hall Effect device was designed and constructed to measure the Hall Effect voltage for doped semiconductor material. The devices will be used in future electronics classes as a demonstration of the electron-hole theory of semiconductor material.

Isaac Putnam is a resident of Washington State where he studied at Western Washington University for two years. He is now a sophomore studying Electrical and Computer Engineering at the Virginia Military Institute and plans to commission into the United States Air Force after graduation.

Emergency Underground Communication Using Seismic Waves
Will Flathers, VMI

Despite the unparalleled technology advancements of our century, mining continues to be one of the most dangerous industries in America (Bureau of Labor Statistics 2002). Currently, following a mine collapse, all communication is cutoff. Landlines are instantly severed by the force of the collapse, and radio signals are absorbed in the conductive earth. The purpose of the Extremely Low Frequency Seismic Detector (ELFSD) is to improve mine safety by communicating directly through the overburden to emergency services on the surface. An underground transmitter and portable topside receiver have been developed that allow trapped miners, with a limited supply of oxygen and potentially in need of medical help, to communicate their condition with the outside world. Similarly, the system allows emergency personnel to detect and locate survivors. When activated, the transmitter continually transduces a signal into the ground as seismic energy. The receiver collects and processes the ground signal. The presence of a valid signal indicates survivors. The transmitter, built from a 12" speaker and a 275 watt amplifier, generates a continuous, tunable, extremely low frequency (40 to 200Hz) sine wave. The

wave is transduced as seismic P-waves into the ground using a modified voice coil and spider springs. Geophones in the topside receiver collect the signal from the ground and a high-Q bandpass filter removes noise around the desired frequency. The signal, though, remains 100,000 times weaker than the ambient noise. The computer integrates the signal over a relatively long period and uses Fourier Transforms to extract it from the overpowering noise. A MATLAB application has been created to perform the transforms, log the data, and graphically display the result in realtime. The prototype system has been successfully tested surface-to-surface at a range 200 feet. The ELFSD concept can be expanded for two-way communication, multiple bit messages, and mobile transmitters.

Will Flathers, from Meadowdean Farm in Rixeyville, VA, is currently a junior at the Virginia Military Institute majoring in Electrical and Computer Engineering. He plans to commission in the United States Air Force upon graduation and hopes to fly, ultimately returning to engineering.

Design and Layout of a Nanosensor Array and Readout Circuit
Marcus Oliver, Virginia Tech

This paper will detail the design and layout of a nanosensor array for various applications using a new sensing technology. The goal is to develop a test structure using an existing silicon process with minimal post-processing. This test structure will contain a number of nano-functionalized microspheres which function as variable resistors. A number of different array structures are designed and laid out, making use of different sets of metal layers, and different methods of opening passivation over the arrays. Also, holes for the microspheres are constructed in varying diameters and shapes. Additionally, access circuitry and readout circuitry for the sensor must be designed. A direct method of accessing the arrays one cell at a time is devised and implemented. A Delta-Sigma converter is selected for the readout circuitry, to convert the resistance levels to a discrete digital output. This project is part of a larger push to create a wireless sensor microsystem, with the ability to detect multiple chemical and biological agents on a single chip.

Marcus Oliver, from Crewe, VA, is a senior Electrical Engineering major at Virginia Tech, and expects to graduate in May 2007.

Framework for Design, Verification and Analysis of SystemC
Derek O'Neill, Nick Sandonato, and Tariq Islam, Virginia Tech

SystemC has gained considerable traction in the electronic system level design industry, and it is well positioned as the defacto system level design modeling and simulation environment. It is an open-source library of C++ classes enabling hardware designers to model and simulate register transfer level (RTL) and abstractions above RTL design aimed at fast design space exploration. With the emergence of SystemC, designers experienced a lack of supporting tools for the purposes of development, analysis, verification, debugging and synthesis. Our work provides an Eclipse-based (open development platform) framework consisting of three components that ease the tasks of (1) development, debugging and simulation, (2) static analysis, and (3) model-based verification of SystemC designs. The current status of the Eclipse-based design and verification framework requires the integration of the above mentioned three components. However, currently they are standalone. Our future work involves using the component for static analysis for better syntax highlighting and content-assist for the IDE as well as source code translations for efficient designs. The verification component neatly ties into the framework by providing a higher abstraction model checking aspect to SystemC design where designers can describe the essence of the design in SPIN and verify crucial properties. These three components are aimed at assisting designers with tools for improved productivity.

Derek O'Neill, from Reston, VA is senior Computer Engineering major at Virginia Tech, and expects to Graduate in May 2007. He has been doing research at the FERMAT lab at Virginia Tech since September 2006. Nick Sandonato, from Wexford, PA, and Tariq Islam, from Herndon, VA both graduated from Virginia Tech in December 2006 with BS degrees in Computer Engineering

IEEE CONSULTANTS AFFINITY GROUP/VMS

The Virginia Mountain Section Consultant's Network Affinity Group has been officially approved by IEEE. The purpose of this Affinity Group is to share information concerning consulting opportunities, and to make a list of consultants and their areas of expertise available to potential employers.

The following is the current listing of consultants:

1. **Tutle International Tech. Marketing**, **Roanoke**
(540)977 4007, Re Electromechanics, Robotics.and Intellectual Property Processes.

2. Squire Consulting,
www.jimsquire.com. Biomedical engineering, instrumentation, endovascular stenting, patent litigation.

3. David H. Geer, PE
Geer & Associates, LLC
540-774-4905
d.geer@ieee.org
Mathematical models for industrial processes.
Software development and maintenance in C, C++, Ada, and Fortran.
Website design, development, and maintenance.

4. Ingrid Burbey, IT Works Software Development.
iburbey@vt.edu
Website: filebox.vt.edu/users/iburbey
Embedded, real-time systems, C, Assembly
Woman-owned Business Enterprise (certified in Virginia)

Anyone wishing to be added to this group, or desiring more information should contact Ed Tutle, Affinity Group Chair, tutleone@earthlink.net.

CONGRATULATIONS

We are pleased to congratulate **Darren Honaker** who was elevated to IEEE Senior Member in January 2007. Senior Member status is a recognition by one's peers of career achievement and contribution to the profession.

The IEEE has a special program each year to promote Senior Member upgrades. This program makes it easy to process a Senior Member application and it gives a financial incentive of a $10 rebate to the Section for every new Senior Member that is approved.

If it is at least 10 years since you received your undergraduate degree, and you have had significant engineering responsibilities and accomplishments in the last five years, you likely qualify for senior membership. **Please consider upgrading your membership, and remember to mention VMS in your application so we get the appropriate credit and rebate.**

VMS Membership

	12-06	2-07
Associate Members	17	21
Affiliate Members	48	48
Members	271	287
Life Members	22	24
Senior Members	72	71
Life Senior Members	16	17
Fellows	15	15
Life Fellows	11	12
Student Members	230	232

Not counting Students, Associates, and Affiliates we now have 426 members (up from 407 at the end of 2006) of whom 53 are in the various Life categories (up from 49). Of these 427, 311 are Members or Life Members (up from 293), 88 are Senior Members or Life Senior Members (same as end of 2006) and 27 are Fellows or Life Fellows up from 26.Thus are membership is up significantly, and hopefully this will be reflected by increased attendance and involvement in VMS activities,

National Science Foundation Requests $6.43 Billion for Fiscal Year 2008
(February 5, 2007 NSF Press release)

NSF proposed an investment of $6.43 billion in fiscal year (FY) 2008 for programs to advance frontiers of research and education in science and engineering. The request includes an increase of nearly $409 million over the FY 2007 request of $6.02 billion.

In addition to continuing ongoing projects, the new budget emphasizes new research on improved computing abilities to meet the challenges of 21st Century inquiry, as well as polar research, ocean research, nanotechnology, education and international collaborations.

Last year, the president's American Competitiveness Initiative (ACI) committed to doubling over the next 10 years investments in NSF programs and those of other federal agencies that fund physical sciences and engineering. That promise recognizes the vital role those disciplines play as major drivers of U.S. economic well being, innovation, education and international leadership. NSF's request of an 6.8 percent increase reflects that commitment.

While the ACI specifically supports advances in mathematics, physical sciences and computing, the multidisciplinary nature of modern research, infrastructure support and human resources make it difficult to draw distinct lines between areas of investigation and support. Natural systems, for example, provide stunning examples of effective communication, complex computation, efficient signaling, adaptive self-organization, and multimodal sensing using small but complex chemical and physical networks. Studies of such biophysical systems will engage physical and computer scientists, engineers, biologists and social scientists. All will demand creative approaches in the ultimate convergence of the physical, bio-, nano-, info-, neuro-, and cognitive sciences.

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