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Southern Minnesota Section Newsletter

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Analog Light Processing: A New Component for Optical Communication

by Mark Hagen

Texas Instruments has had a design center in Rochester for a little more than a year now, yet few people know what has been going on there. Ask an average person on the street and they may say, "They make calculators, don't they?". An electrical engineer might give a more informed response: "Texas Instruments, they're the world leaders in DSP and analog circuit semiconductors. But I don't know what they do in Rochester."

The original mission for the Rochester site was to support the development and sale of integrated circuits to the disk drive industry, and we are still involved in that activity. But since last September we have also been developing the interface and control electronics for a new class of devices useful for optical communication. These devices are part of a concerted effort by Texas Instruments to bring to the market optical products based on *MicroElectroMechanical Systems* (MEMS) technology.

Digital Light Processing (DLP) Technology

Video projection technology took a giant step in 1987 with the advent of the *Digital Micromirror Device*™ (DMD™), invented by Larry Hornbeck of the Texas Instruments Central Research Laboratories. *Digital Light Processing*™ (DLP) is a matrix of tiny silicon mirrors that comprise the basis of a reflective display system driven by digital electronics.

After nine years of extensive research and development, TI produced the first commercially available digital projector engine under the brand name DLP. To reduce risk and time to market, TI offered DLP technology as a complete package that included the DMD, control signal processing, optics, power supply and lamps. The DLP market can be broken down into several opportunities. The business projector market includes video walls, large venue, conferencing and mobile solutions, while the entertainment market includes consumer applications and digital cinema. TI DLP technology can also provide a powerful, flexible platform for a broad range of products for wavelength-routed Dense Wavelength Division Multiplexing (DWDM) networks.

Analog Light Processing (ALP) Technology

DLP devices are digital. That is, each element can be switched on or off. There is another range of applications where precise continuous (analog) positioning of a beam of light is required. One of these applications is optical wireless or Free Space Optical communication.

In optical wireless communication, a laser is modulated by a digital data signal and the modulated beam reflected by the analog micromirror so that it is positioned over and received by another optical wireless unit across free space. Usually the modulation/coding protocol is the same as that used in fiber optic cables. The free space distance can be as short as a few centimeters, in an optical

continued on reverse

IEEE Section Meeting

Mark Hagen, Texas Instruments

Analog Light Processing

Monday, May 21, 6:30 pm
Mayo Medical Sciences Building
(321 3rd Avenue SW, Rochester)

☞ *Pizza & socializing at 6:30 pm* ☜

Mark Hagen is a program manager at Texas Instruments, Inc., which opened a Rochester location about one year ago. TI's Rochester organization has the responsibility for developing and supporting chips for the disk drive market as well as for the development of ALP technology.

Prior to working at TI, Mark worked for 16 years in the disk drive industry, first with IBM and then with Western Digital. His experience with disk drives includes circuit board testing, servowriter design, servo control, servo channel design, preamp design, flex circuit design, read channel design and disk controller design.

At IBM Mark directed the development of the first use of a magnetoresistive head in a servo read channel. At Western Digital he was responsible for defining the basic bits-per-inch and tracks-per-inch design point for new disk drive products.

Mark attended Concordia College in Moorhead and the University of Minnesota. He has a BS in Electrical Engineering. Mark has been an IEEE member for the past three years.

Erratum

The following attributions were omitted from the article, *Data Quality: Why Should You Care?*, published in the February 2001 newsletter: 1) Kahn, B., et al, *How to Get an Information Quality Program Started: The Ingenix Approach*, 2000 MIT Conference on Information Quality; 2) Wall Street Journal, 12/4/97; 3) Loshin, D., *Payback*, Intelligent Enterprise, 8/18/00; 4) Turner, N., and Hodges, J., *The Drive to High IQ in British Telecommunications plc (BT); Deploying Information Quality Tools in a Federated Business*, 2000 MIT Conference on Information Quality. This information was provided by Frank Dravis.

switching network device, to several kilometers for a broadband optical communication network such as that proposed by companies such as Terabeam.

Why pursue optical wireless communication instead of radio frequency wireless, or instead of laying fiber optic cable? *Time and money*. It would be great to have a 1-Gb/s fiber cable providing broad content to our homes, but this has proven very expensive to install. RF wireless also has many costs, including the spectrum license, and issues of data security. Today there is no cost to use the air for optical communication. Also, the narrow beam of optical wireless transmission is inherently more secure than RF communication.

One of the big challenges to making optical wireless communication work well is in acquiring and maintaining the laser beam on a remote unit's receiver. This is where another core competency of Texas Instruments comes into play. By using a powerful digital signal processor, processing algorithms and the continuous positioning capability of the ALP micromirror, the optical wireless units search for and acquire each other. Once found, the units pass positioning data between each other and maintain tracking through vibration, movement or apparent movement, such as atmospheric scintillation. Many of these control problems are in fact similar to those found in disk drives, which has made the TI Rochester team uniquely qualified to develop solutions to the optical wireless application.

For the May 21st IEEE talk we will demonstrate the acquisition and communication capability of a optical wireless application using Texas Instruments' DSP and ALP technology.

The Institute of Electrical and Electronics Engineers, Inc.
Southern Minnesota Section

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IBM Volunteer Needed

We need a volunteer from IBM to create a program that uses the Blue Pages API to acquire internal IBM email addresses for IEEE members who are IBM employees. If you're interested, contact Chris Kimble (ckimble@us.ibm.com, 253-7571).

Automotive Electronics Is Topic at Coulee Meeting

Professor Tom Jahns, University of Wisconsin–Madison, will discuss automotive electronics at a Coulee Subsection meeting on May 22. The location of the meeting has not been finalized; check our website (www.ewh.ieee.org/r4/southern_minnesota) for details.

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