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High-Power Diode Lasers: How They Work and Where They Live

Date/Time: Thursday, February 16, 2006, 11:45 AM - 1:00 PM
Speaker: Dr. Rob Williamson, Director of Marketing, Alfalight, Inc.
Location: Rocky Rococo's Pizza, 7952 Tree Lane (Madison Beltline Hwy. at Mineral Pt. Rd.), 608.829.1444
Menu: Pizza buffet, salad and soft drinks (cost $10.00, free for student members)
RSVP: by February 13th to Les Schroeder via e-mail (l.schroeder@ieee.org) or call 608.444.9144

Non-member guests are always welcome!

High-power diode lasers are a key component in a broad range of applications, including telecommunications, industrial lasers for material processing, as well as in defense, medical, printing, display, and scientific applications. Recent research and development efforts have made tremendous improvements in many of the key performance characteristics of diode lasers, including power conversion efficiency, spatial brightness, and spectral quality. These performance boosts have substantial impact on a wide range of systems pumped by high-power diode lasers.

This talk will outline the properties and operating principles of high-power infrared diode lasers and the manufacturing processes used to make them, highlighting how these recent revolutionary performance improvements have been achieved. We will also explore the architectures of several systems incorporating diode lasers, including optical communications (CATV/FTTH), high power fiber lasers for material processing (cutting and welding), free-space communications, and kilowatt-class lasers.

Rob Williamson is currently the Director of Marketing at Alfalight, a high-power diode laser manufacturer in Madison, Wisconsin. In his previous roles, he has led the development and marketing of high-speed optical communication devices, ultrastable lasers, and other optoelectronic instruments for telecommunication and industrial applications. Dr. Williamson has a Ph.D. in Physics from the University of Wisconsin - Madison and a B.S. in Physics from Caltech. He holds four patents, has published numerous papers and articles, and has led development efforts in the IEEE Ethernet Standards Committee. He is a member of IEEE Lasers and Electro-Optics Society, the American Physical Society, and Sigma Xi.

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Let's Not Overlook Standards

By Allison Ickowicz

Engineers designing products know that they must comply with certain formal standards if the fruits of their labor are to be widely used, but few U.S. engineering students know much about them. The IEEE hopes to change that, thanks to educational materials about standards it put up on the Web this month. Its aim is to impart information about standards to university students, faculty members, and just about anyone else who might be interested.

The material was developed in response to criteria set by the Accreditation Board for Engineering and Technology (ABET), which accredits engineering programs at U.S. universities. Criterion 4 of the latest guidelines document, introduced in 2000 and known as ABET 2000, says that students must be prepared for "engineering practice" through a curriculum that culminates in a major design project "incorporating engineering standards and multiple realistic constraints." The IEEE is one of the engineering organizations that sits on the ABET board, and through its members helps evaluate the quality of university programs in engineering and engineering technology.

Task Force

To meet ABET's requirement, the IEEE in 2003 formed the Standards in Education Task Force, which has representatives from the institute's Educational Activities Board and Standards Association, and financial support from the IEEE Foundation.

"It is crucial that engineering students learn how to use standards in their classes and senior design projects, just as engineers working in industry use standards when they design products and services," says IEEE Life Fellow Ted Bickart, the cochair of the task force. "Standards are an essential element for engineering and engineering technology practice if we're going to create products and processes that will serve the world over." Bickart, a retired professor of electrical engineering, is from the IEEE Educational Activities Board.

Over the past two years, the task force has written a number of documents that include case studies and the first of several tutorials that together cover the history of standards and their effect on products, processes, and designs. The tutorials focus on particular technical areas. The first is about standards applicable to mobile telephony, and another on standards in power systems is to be completed in the next few months. Ultimately, Bickart would like to see a standards tutorial developed for each of the IEEE's technical fields of interest.

A glossary is also available that defines common standards terms and phrases found in the tutorials and case studies. And a reference guide lists standards-related terminology alphabetically, including acronyms and abbreviations, plus the names of standards-development organizations. These materials can all be accessed from a Web site called the Standards in Education Web Portal.

The U.S. National Science Foundation (NSF) awarded a US $100 000 grant last May to the task force and to two universities to introduce the standards materials and the portal in their undergraduate electrical and computer engineering and engineering technology programs during the 2005, 2006, and 2007 academic years. The Colorado School of Mines, in Golden, and DeVry University, in North Brunswick, N.J., are the two schools chosen.

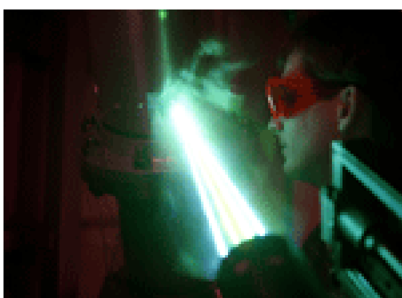
At Colorado, for example, seniors are going to the portal to get details on standards before they begin research for their senior projects, according to Doug Sutton, the school's industry liaison and a lecturer in the school of engineering, and Melvin Capehart, an instructor in electrical engineering. Instructors at DeVry have begun using the materials in sophomore and junior electronics and telecommunications classes, says Eric Addeo, a professor of electrical engineering and telecommunications.

The task force is also sending the materials to other universities, notes Bickart. His group is looking to partner with other engineering societies, especially those involved in accreditation activities, so they can develop similar teaching aids for other fields. If Colorado and DeVry provide good reviews, the standards task force will apply for another NSF grant to help it incorporate the materials first into instruction in other schools in the United States and Canada and eventually into university curricula worldwide.

The Standards in Education Web Portal is at www.ieee.org/standardseducation. The materials, useful to anyone interested in learning about standards, are available at no charge. For more information about the portal or activities of the Standards in Education Task Force, contact Tara Gallus at t.gallus@ieee.org.

New Technologies — "Shaken, Not Stirred"

By Frederik Nebeker



When *Goldfinger*, the third James Bond movie, opened in 1964, most people had never heard of a laser, even though Ted Maiman at Hughes Aircraft had built such a device in 1960. An early scene in the movie featured an industrial laser, which Auric Goldfinger helpfully explained for Bond — and the grateful audience. The studio was proud of this scene, boasting in a press release that the movie "is sure to give the laser its greatest international publicity as a scientific development of great power and worth in the modern world." (The studio is today no doubt proud of some classic lines in that scene: "Choose your next witticism carefully, Mr. Bond, it may be your last"; and Bond: "Do you expect me to talk?"; Goldfinger: "No, Mr. Bond, I expect you to die.")

In 21 films over four decades, the Bond movies have introduced many new technologies to the public. *From Russia with Love* (1963), the second Bond movie, shows the use of a beeper, eleven years before Motorola's Pageboy, the first commercially successful beeper in the United States. Many people learned for the first time about numerous other communications devices from Bond movies: the scrambler used in *Thunderball* (1965) utilized a form of secure communications; a videophone appears in a car in *You Only Live Twice* (1967); miniaturized two-way radio, in the form of a lady's compact in *On Her Majesty's Secret Service* (1969); video conferencing is portrayed in *Never Say Never Again* (1983); a frequency scanner is used to locate police radio, in *The Living Daylights* (1987); electronic money transfer, in *GoldenEye* (1995); and using a cell phone to take a picture and transmit it elsewhere, in *Die Another Day* (2002).

The Aston Martins, Ferraris and other cars that Bond has driven have attracted a great deal of attention. So have various technologies found in vehicles, such as a plan-position-indicator screen allowing Bond to track a planted transmitter in *Goldfinger* (1964); cruise control in a tanker truck in *Licence to Kill* (1989); remote control of a BMW in *Tomorrow Never Dies* (1997); and the navigation system in a speedboat that allows Bond to take a shortcut through London in *The World is not Enough* (1999).

New military technologies are present in many Bond movies. There is an infrared scope on a sniper rifle in *From Russia with Love* (1963) and night-vision goggles in *The Living Daylights* (1987). A surveillance satellite tracks submarines with an infrared camera (using "heat signature recognition") in *The Spy Who Loved Me* (1977). Two important anti-radar techniques, both developed during World War II, are shown: jamming in *Moonraker* (1979) and antiradar coating (of a stealth ship) in *Tomorrow Never Dies* (1997). We learn about AWACS planes in *Licence to Kill* (1989) and about terrain-following cruise missiles (seeing how the guidance system finds a match between stored information and observed terrain) in *Never Say Never Again* (1983). *The Living Daylights* (1987) shows the use of a heads-up display for firing missiles, and *The World is not Enough* (1999) shows a sniper using a laser to fix a target.

Not surprisingly, security systems occur in many Bond movies. *Diamonds are Forever* (1971) shows the surveillance system in a casino, and video surveillance plays a large part in *Octopussy* (1983). *Licence to Kill* (1989) includes a pistol with "signature grip," allowing it to be fired by a specific person only. Several techniques for access to secure areas are shown: iris-pattern matching in *Never Say Never Again* (1983), voice-matching in *GoldenEye* (1995), and handprint-matching in *Die Another Day* (2002).

The first Bond movie, *Dr. No* (1962), contains an explanation of a Geiger counter. *A View to a Kill* (1985) presents a surveillance robot. Several Bond movies, the first of them being *For Your Eyes Only* (1981), show the automatic searching of an image database. New consumer-electronics products appear in Bond movies, such as the Pulsar digital watch in *Live and Let Die* (1973), and a liquid-crystal TV screen in *Octopussy* (1983).

The Bond movies have made people interested in technology, but along with the presentation of actual or feasible devices is an admixture of fantasy technology. The "active camouflage" that makes a car invisible in *Die Another Day* (2002); the Rolex wristwatch that produces a magnetic field powerful enough to deflect a bullet in *Live and Let Die* (1973); and the electronic device implanted in the neck that makes one person's voice sound like another person's in *Diamonds are Forever* (1971) are hardly realistic. But most of the technology in Bond movies is quite authentic — even these counterexamples are theoretically possible. The Bond movies have become more and more realistic with time. Many of the gadgets that amazed audiences in earlier decades, such as pagers, portable phones, tracking devices and miniature voice-recorders, have become commonplace.

Frederik Nebeker is Senior Research Historian at the IEEE History Center at Rutgers University in New Brunswick, N.J. Visit the IEEE History Center's Web page at: www.ieee.org/organizations/history_center.

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