

# mechanics

Academia Americana de Mecánica

American Academy of Mechanics

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# mechanics

*mechanics* provides its readers with news in the field of theoretical and applied mechanics, and serves as a forum for the presentation and discussion of issues related to the development of the science and profession of mechanics. Opinions expressed are those of the authors and do not necessarily reflect official points of views of AAM or the institutions with which the authors are affiliated.

*Editor:* Horacio D. Espinosa (Northwestern University, U.S.A.)

*Associate Editors:* Gustavo Buscaglia (Balseiro Institute, Argentina), Gerardo Diaz (Universidad de Chile), Djenane Pamplona (PUC-Rio, Brazil), Luis Suarez (Universidad de Puerto Rico).

The *American Academy of Mechanics* is a non-profit corporation incorporated in 1969 under the laws of the Commonwealth of Pennsylvania. Its objective is to advance the science and profession of mechanics, with particular reference to the countries of North, South, and Central America. It aims to facilitate cooperation among mechanicians, to encourage recognition of achievements in mechanics, and to promote public understanding of the work of the mechanician.

*Board of Directors* (2001): President and Chairman of the Board: C.W. Bert (University of Oklahoma); Immediate past President: M. Beatty (University of Nebraska); Secretary: D.T. Mook (Virginia Polytechnic Institute and State University); Treasurer: R.A. Heller (Virginia Polytechnic Institute and State University); Director, Region IA (Eastern USA): L. Virgin; Director, Region IB (Central and Western USA): S. Datta (University of Colorado); Director, Region II (Canada): M. Paidoussis; Director, Region III (Central and South America): P. Kittl (Universidad de Chile); Publisher: R.M. Haythornthwaite (Temple University); Secretary to the Fellows: *position open*.

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**American Academy of Mechanics**  
**Academia Americana de Mecánica**

# POSITION OPENINGS

## National Science Foundation Civil and Mechanical Systems (CMS) Division

Greetings:

I would like to inform the mechanics community that Dr. Jorn Larsen-Basse, who served as a program manager in surface engineering and materials engineering for many years, has informed NSF of his intention to retire at the end of this calendar year. I encourage you to express your appreciation to Dr. Larsen-Basse for his years of service to your community - he has done a wonderful job!

At this time, the Civil and Mechanical Systems (CMS) Division has vacancies for Program Managers in the three Program areas, one of which is the 1633 program:

- The Structural Systems and Hazards Mitigation of Structures (SSHM) Program (1637)
- The Dynamic System Modeling, Sensing and Control (DSMSC) Program (1632)
- The Solid Mechanics and Materials Engineering (SMME) Program (1633)

The link to the CMS web page is <http://www.eng.nsf.gov/cms/> and descriptions of these opportunities can be found through that page.

I expect that you know of colleagues who would be good candidates. Please consider and send the names and contact information for those you wish to nominate to me ([pnelson@nsf.gov](mailto:pnelson@nsf.gov), 703-292-7018) or to the CMS Search Coordinator (Dr. Richard Fragaszy, [rfragasz@nsf.gov](mailto:rfragasz@nsf.gov), 703-292-7011).

These positions are not limited to individuals who currently hold academic positions, so think about anyone you might know in industry or in a government job as well as faculty members. The CMS Division needs highly qualified individuals to manage existing programs and to expand the grant opportunities we provide for Civil, Mechanical and related engineering disciplines. We all benefit from having well qualified, enthusiastic staff in CMS.

In addition, we are advertising for the important position of George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) Equipment Project Coordinator. This position has been occupied by Dr. Thomas Anderson, and he has informed NSF that he will be leaving this position during this summer after two years of service. We thank Tom for his contributions, and encourage you to consider nominating persons from academe or industry for this very important position.

The position of Division Director (currently my position) is also being advertised. We need your help in identifying highly qualified candidates for all of these positions.

Please feel free to contact me if you have any questions.

Best regards,

Dr. Priscilla P. Nelson  
Director, Division of Civil and Mechanical Systems  
National Science Foundation  
4201 Wilson Boulevard, Suite 545, Arlington, VA 22230  
Tel: (703) 292-7018 (direct) or 292-8360 (general), Fax: (703) 292-9053  
[pnelson@nsf.gov](mailto:pnelson@nsf.gov)



Civil Engineering  
School of Engineering and Applied Science  
Department Chair Position

The University of Virginia School of Engineering and Applied Science invites applications for the chairperson of the Department of Civil Engineering. The University of Virginia has approximately 18,000 students pursuing degrees in nine colleges and professional schools, including the School of Engineering and Applied Science (SEAS). The University of Virginia is consistently ranked as one of the top public universities in the country. The School of Engineering and Applied Science has approximately 2,000 undergraduate students, 600 graduate students, 150 tenure and tenure track faculty members in nine departments, and conducts approximately \$40 million per year in externally funded research programs. The Department of Civil Engineering has more than 150 undergraduate students, 75 graduate students, and 15 faculty members. The department offers B.S., M.S., M.E., and Ph.D. degrees in civil engineering. The department has undergone significant growth and programmatic evolution. The department is implementing a new undergraduate curriculum, actively expanding its graduate research program, and is engaged in multi-disciplinary programs with other departments, schools, and universities. Active research programs exist within three main thrust areas: environmental and geo-environmental engineering; structural engineering and applied mechanics; and transportation systems, operations, planning, and safety. We seek a chairperson who can provide leadership for a department committed to excellence in teaching, research, and service, guide the growth of new promising directions, and visibly enhance the department's national stature.

**Requirements:** Candidates must have an earned doctorate in an appropriate discipline and an outstanding record of scholarship and research achievement. Candidates with exceptional credentials will be considered for an endowed professorship. Applications will be reviewed as they are received and until the position is filled.

**Interested Candidates** please submit a letter of application to:

Professor James H. Aylor, Search Committee Chair, Ref. #5954, School of Engineering and Applied Science, Dept. of Electrical & Computer Engr., University of Virginia, 351 McCormick Road, P. O. Box 400743, Charlottesville, VA 22904-4743; Email: [jha@virginia.edu](mailto:jha@virginia.edu); Phone: 434-924-6100.

Applicants are encouraged to visit the departmental website for more information at: <http://www.cs.virginia.edu/~civil/>.

The University of Virginia is an equal opportunity, affirmative action employer.



**Department Head**  
**Department of Engineering Science and Mechanics**  
**Virginia Polytechnic Institute and State University**

The Department of Engineering Science and Mechanics at Virginia Tech invites applications and nominations for candidates for the position of department head. The Department of Engineering Science and Mechanics (ESM) is a unique department within the College of Engineering at Virginia Tech in that it views physical phenomena from a fundamental level rather than through specialization, as in other departments. The graduate program has an outstanding international reputation and stresses the classic disciplines of solid mechanics, fluid mechanics, and dynamics, and has been increasing course offerings in the biomechanics area. The department is also known for interdisciplinary research and educational activities with departments inside and outside the College of Engineering. The department offers Ph.D. and M.S. degrees in Engineering Mechanics, an accredited undergraduate degree in Engineering Science and Mechanics, and teaches core mechanics courses for the 10 other departments within the college. The department has 28 full-time faculty, an undergraduate enrollment of 70, a graduate enrollment of 90, and annual research expenditures of \$6.5M. Screening of candidates will begin with the strictest of confidence on September 16, 2002 and will continue until the position is filled. A detailed description of the position and the nomination and application process can be found at <http://www.esm.vt.edu>.

Virginia Tech has a strong commitment to the principle of diversity, and in that spirit, seeks a broad spectrum of candidates including women, minorities, and people with disabilities. Individuals with disabilities desiring accommodations in the application process should notify Nancy Linkous, 540-231-3243(V), or by way of the Telecommunication Relay Service number, 711, 8 am – 5 pm Eastern US Time.

**ANNOUNCEMENTS****ADVERTISEMENT POLICY**

Upon the decision of the Board of Directors, an advertisement for a position opening is charged a flat rate of \$200. Payment must be done only by check and sent to:

**American Academy of Mechanics****Horacio D. Espinosa, Editor**

Northwestern University

2145 Sheridan Road

Evanston, IL 60208

e-mail: mech1@clifton.mech.northwestern.edu

The FID number for AAM is 23-7045163. Make check payable to American Academy of Mechanics. Announcements for forthcoming events, conferences, and workshops are free of charge. Advertisements may be sent by FAX or e-mail (LaTeX, MSWord, PDF or plain text). Logo of the institution may be included if the postscript (graphic file) is provided.

Mechanics is a bi-monthly magazine. To be considered for publication in forthcoming issues, an advertisement must be received one month in advance of the publication date. For example, an advertisement must be received before the end of November to appear in the January-February issue. Please note that the magazine is distributed at the beginning of the two-month period. The advertisement will continue to appear in future issues until the deadline of the position opening.

Visit the AAM website to read recent advertisements of position openings and past issues of Mechanics at <http://www.AAMech.org>.

**ASME WEBCAST****[www.asme.org/nanowebcast](http://www.asme.org/nanowebcast)***(for registration & information)*

October 16, 2002; 2:30 pm EST

**RESEARCH & CHALLENGES IN NANOMECHANICS**

By

**KEN P. CHONG**

Director of Mechanics &amp; Materials

National Science Foundation

Guest Researcher, NIST

## **AAM AWARDS NOMINATIONS**

The Awards Committee of the American Academy of Mechanics requests nominations for the following two awards to be presented at the upcoming ASME International Mechanical Engineering Congress and Exposition in November, 2002

### **The 2002 American Academy of Mechanics Outstanding Service Award**

Preliminary nominations should consist of a one-page letter describing the outstanding service of the nominee to the Academy as well as to the profession, along with a one-page biographical sketch of the nominee, together with the names of at least three people willing to write letters of support in the event that the Awards Committee requests them.

### **The 2002 American Academy of Mechanics Junior Award**

This award, which will be based primarily on research accomplishments, is open to mechanics whose highest degree was conferred after December 31, 1991.

Preliminary nominations will consist of a one-page nominating letter, one-page curriculum vitae, and re- (or pre-) prints of the candidate's best three papers. In the case of co-authorship of any work submitted, the candidate's contribution must be clearly and explicitly indicated in an attached note.

*Please Note:*

*All preliminary nominations for both awards must be postmarked by August 1, 2002.\* Those that do not arrive in a timely fashion will not be considered.*

*Once the preliminary materials are reviewed, additional biographical and complete dossiers may be requested of applicants under consideration.*

*For additional information, please do not hesitate to contact Simon Ostrach at [sxo3@po.cwru.edu](mailto:sxo3@po.cwru.edu) or Stephen Crandall at [crandall@mit.edu](mailto:crandall@mit.edu), who are current members of the awards committee.*

### **AAM Awards Committee**

Simon Ostrach, *Chair*, Stephen Crandall, Tinsley Oden, Wolfgang Knauss, Romesh Batra

**\* Please note change in submission date from previous years.**

**NOMINATIONS FOR FELLOW OF  
THE AMERICAN ACADEMY OF MECHANICS**

**NOTES:**

- Persons nominated must be members of the Academy (Bylaws, III 1).
- Nominations must be made by two of the Fellows (Bylaws, III 2).
- Fellows shall be elected on the basis of their contributions to mechanics (Bylaws, III 1).

**Name of the member nominated** *(please print)*

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**Citation** *(please state in no more than fifteen words the basis of the nomination)*

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**Nominated by** *(signatures of two fellows required)*

**Signature:** \_\_\_\_\_

**Printed Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Printed Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Please mail this nomination form (no faxes please!) to:

**Professor C. W. Bert**  
**School of Aerospace & Mechanical Engineering**  
**The University of Oklahoma**  
**Norman, Ok 73019-1052, USA**

so as to reach him on or before September 24, 2002. The nomination should include one good copy of a two-page resume of the member nominated.

## **American Academy of Mechanics**

### **Founders Prize and Grant**

Up to \$10,000 For the Academic Year 2003-2004

(Deadline: July 1, 2003)

The American Academy of Mechanics is pleased to announce the availability of a Founder's Prize and Grant to be awarded in September 2003 to a doctoral candidate in the field of Mechanics. Funding has been arranged by the Robert M. and Mary Haythornthwaite Foundation through the good offices of Professor Haythornthwaite, founder and first President of the Academy. The award will be made on the recommendation of an AAM committee. The prize consists of a Certificate and \$1,000 that will be presented at the annual meeting of the Academy, usually held in November. The Grant will be made to that same person in two installments, \$6,000 in September 2003 and up to \$3,000 in January 2004, the latter dependent on the size of the approved budget and receipt by the AAM committee of an acceptable progress report. In order to encourage contestants to think constructively about the impact of new and pending developments, they will be asked to compose an original essay of no more than a thousand words under the title "Progress through Mechanics". The winning essay will be published in *mechanics*. The award is open to those who, as of July 1, 2003, are registered as graduate students at a degree granting institution within the Americas, have completed at least one year of full-time graduate study at that institution, have been assigned a thesis advisor at the institution and have had a doctoral thesis topic emphasizing mechanics approved by the institution following candidacy or equivalent procedures. There are no restrictions with regard to citizenship, residency, race, religion, or sex. Letters of support will be required of the thesis advisor and in addition one from either a Member or a Fellow of AAM. Contestants will be judged on the basis of the essay, plans, references and academic history. The intent of the Grant is to support the research of the student through an approved combination of equipment purchases, information access, travel, etc., but not routine living expenses or fees. Detailed rules for the competition will be issued soon: to receive them, express your interest to the committee by FAX to (215) 204-6936, or by writing to:

AAM Founders Prize and Grant Committee  
c/o Civil and Environmental Engineering Department  
Temple University (084-53)  
Philadelphia, PA 19122

# **PACAM VIII**

**Eighth Pan American Congress of Applied Mechanics**

**January 5 -9, 2004**

**Havana, Cuba**

<http://www.pacam8.mcgill.ca/>

The Eighth Pan American Congress of Applied Mechanics (PACAM VIII), jointly sponsored by the University of Havana, the Institute of Cybernetics, Mathematics, and Physics of Cuba, and the American Academy of Mechanics, will be held January 5-9, 2004 at the Convention Center, Havana, Cuba. The Honorary Chairman of the Organizing Committee is Prof. Alina Ruiz Jhones of the University of Havana. The Co-Chairmen are Prof. Martin Ostoja-Starzewski of McGill University and Prof. Reinaldo Rodríguez-Ramos of the University of Havana. The Chairman of the Editorial Committee is Prof. Julián Bravo-Castillero of the University of Havana, and the Chairman of the Local Arrangements Committee is Prof. Raúl Guinovart-Díaz of the University of Havana, Cuba.

The aim of sponsors is to promote progress in the broad field of mechanics by (1) exposing engineers and scientists, including graduate students, to new research findings, techniques, and problems, and (2) providing opportunities for personal interactions between mechanics of North and South America, as well as other continents. It is the only conference sponsored by the American Academy of Mechanics (AAM).

The Pan American Congresses of Applied Mechanics are held every two years early in January, always in a Latin American venue, at a time when few other conferences are scheduled. The previous Congresses were held in Rio de Janeiro, Brazil in 1989; Valparaiso, Chile in 1991; São Paulo, Brazil in 1993; Buenos Aires, Argentina in 1995; San Juan, Puerto Rico in 1997, Rio de Janeiro, Brazil in 1999 and Temuco, Chile in 2002. Participants come from the Americas as well as Africa, Asia, Australia, and Europe.

Persons willing to organize special sessions in any area of mechanics are welcome to contact the organizers listed below. All the future announcements will be made at the website listed above, and through the AAM (<http://www.AAMech.org/>). Four-page papers for the conference proceedings will be due June 30, 2003, at either address:

**Latin American Co-Chairman**  
Prof. Reinaldo Rodríguez-Ramos  
Facultad de Matemática y Computación  
Universidad de la Habana  
San Lazaro y L, Vedado, CP 10400  
La Habana, Cuba  
reinaldo@matcom.uh.cu  
<http://www.uh.cu>

**North American Co-Chairman**  
Prof. Martin Ostoja-Starzewski  
Department of Mechanical Engineering  
**McGill University**  
817 Sherbrooke Street West  
Montréal, PQ, Canada H3A 2K6  
martin.ostoja@mcgill.ca  
<http://www.mcgill.ca>

**International Symposium on Dynamic Problems of Mechanics (X-DINAME)*****Dynamics of the Brazilian Society of Mechanical Sciences***

10-14 March, 2003  
Hotel Recanto das Toninhas  
Ubatuba, São Paulo

**Call for Abstracts****Abstract Criteria:**

Abstracts of scientific works are invited in all dynamic problems of mechanics. The work should be original in scope, of outstanding quality and of permanent interest.

**Abstracts are invited in the following topic areas:**

- Structural and machine dynamics
- Control and optimization
- Noise and vibration
- Modal analysis
- Any other correlated subject.

**Information about the meeting:**

The meeting is to take place on the week 10-14th of March, 2003 at Hotel Recanto das Toninhas (<http://www.toninhas.com.br>), Ubatuba, São Paulo. Ubatuba is located somewhere in between Rio and São Paulo, in one of the most attractive and exuberant coastal areas of Brazil, with a consistent touristic structure of hotels and restaurants. It is adjacent to the preservation sanctuary of the Atlantic Ridge Rain Forest and beautiful tropical beaches. The hotel, which is a resort by the sea, provides the right kind of welcoming atmosphere and international standards service which is required for the immersion activities of DINAME. Since the hotel has a limited number of apartments early booking is encouraged.

**Key Deadlines:**

**April 30, 2002:** Last day for submission of abstracts for preliminary evaluation of contributions.

**May 24, 2002:** Notification of selected abstracts and invitation for submission of full texts.

**July 31, 2002:** Last day for receiving full texts.

**August 30, 2002:** Notification of accepted papers and/or required modifications of the text.

**September 30, 2002:** Last day for receiving modified texts.

**January 15, 2003:** Last day for confirming early booking with the hotel.

A home page for the conference is to become available soon. Any additional information can be obtained by writing to the following address: [xdiname@fem.unicamp.br](mailto:xdiname@fem.unicamp.br)

# IUTAM Symposium On Integrated Modeling of Fully Coupled Fluid-Structure Interactions Using Analysis, Computations, and Experiments

1 June-6 June 2003

*New Brunswick, New Jersey USA*

<http://cronos.rutgers.edu/~mechaero/iutam>

## Chairs:

- Haym Benaroya and Timothy Wei, Rutgers University, New Jersey  
[benaroya@rci.rutgers.edu](mailto:benaroya@rci.rutgers.edu) and [twei@rci.rutgers.edu](mailto:twei@rci.rutgers.edu)

## Scientific Committee

- Peter Bearman, Imperial College of Science, Technology and Medicine, UK
- Earl Dowell, Duke University, North Carolina
- Helmut Eckelmann, Georg-August-Universität, Germany
- Peter Monkewitz, IMHEF-EPFL, Switzerland
- Michael Païdoussis, McGill University, Canada
- John Sheridan, Monash University, Australia
- H.K. Moffatt, Isaac Newton Institute for Mathematical Sciences, UK

This Symposium will provide a forum for the latest thinking in analytical, computational and experimental modeling of structures interacting with fluid environments. The specific objective is to provide a structured format in which meaningful and lasting dialogues can be facilitated between leading researchers in the different component disciplines. It is intended that, through these dialogues, multidisciplinary linkages will be established leading to integrated approaches to modeling the complex, nonlinear interactions between fluids and structures. Examples of classes of interactions that may be addressed in this Symposium include ocean structures, fluid conveying structures, and aerospace structures. The energy transfer processes are inherently nonlinear in all aspects of the behavior. The important class of vortex-induced oscillations has regions of lock-in, where the structural natural frequencies rather than the fluid velocity govern the shedding, and there exists hysteretic behavior. The real fluid-structure system is one of complex exchanges of forces and energies, resulting in highly nonlinear behaviors. The ability to model, solve and test fully coupled fluid-structure systems portends a rich and profound understanding. In fact, recent research efforts have indeed started to focus on the development of fully coupled models. This Symposium is therefore a response to these new and exciting developments in the field. By bringing together a critical mass of key researchers in each discipline, and organizing the program to focus on multidisciplinary problem solving, this process of developing fully coupled fluid-structure interaction research programs can be reinforced and enhanced. We look forward to receiving abstracts for review, presentation, and eventual full publication, of topics that fall within the broad framework defined above.

## DEADLINES

**Submission of Abstracts: 1 February 2003**

**Notification of Acceptance: 15 March 2003**

**Hotel & Symposium Registration: 1 May 2003**

**Symposium: Sunday 1 June – Friday 6 June 2003**

**Final Manuscripts Due: Friday 13 June 2003 (FIRM)**

**TRIBOTESTING FUNDAMENTALS****Call for Papers for the 58th Annual Meeting of the Society of Tribologist and  
Lubrication Engineers (STLE)**

April 27-May 1, 2003 in New York City

Online submission form at [http://www.stle.org/offer\\_of\\_paper/offer\\_form.cfm](http://www.stle.org/offer_of_paper/offer_form.cfm)

Dear Colleague:

It is my pleasure to invite you to participate in a STLE technical session of great importance in the field of tribology, namely, Tribotesting Fundamentals. The session will attempt to combine the many efforts of scientists and engineers to arrive at a common understanding of the fundamentals, procedures and testing, calculations and modeling, data presentation and other practical issues of tribology testing. Ultimately, the aim of the sessions is to identify and resolve problems of current tests and measurements, extend their limits to new industrial applications, standardize new important tests, and support development of novel techniques and equipment for friction and wear testing. *While any and/or all of these and related topics are welcome, special emphasis will be placed on developing and understanding the procedures and modeling techniques required to accurately match the wear modes and damage mechanisms experienced in many applications.*

1. The planned sessions will include (but are not limited to) the following topics.
2. Fundamentals of friction and wear testing for various practical applications from the nano-to-macro scale.
3. Pathologies for determining and matching wear modes and damage mechanisms.
4. Advanced test procedures for tribology and reliability testing of materials, gears, and bearings that can match observed wear and damage modes.
5. The influence of coatings, and lubricants (including oils, greases, and solid lubricants).
6. Modeling of friction and wear for the optimization of bench-top tests.
7. Advanced test equipment for tribology testing.
8. Standardization of test procedures and test equipment.

**Please use the online form at** [http://www.stle.org/offer\\_of\\_paper/offer\\_form.cfm](http://www.stle.org/offer_of_paper/offer_form.cfm)  
or **mail, email, or fax this Offer to:** A.E. Segall, The Pennsylvania State University, Department of  
Engineering Science and Mechanics, 212 Earth and Engineering Science Building, University Park, PA  
16802 **Phone** (814) 865-7829 **Fax** (814) 865-9974 **Email** [aesegall@psu.edu](mailto:aesegall@psu.edu).

I am looking forward to receiving your Offer of Paper and seeing you in NYC.

Al Segall  
Engineering Science and Mechanics

**Important Dates and Items:**

Offer of Paper Form Submission: **August 31st, 2002**  
STLE Web Registration of Paper: **September 15th, 2002**  
Manuscripts (not required for presentation): **October 2nd, 2002**

*Preliminary Announcement***Dr. Daniel C. Drucker Memorial Symposium****October 8-10, 2002****A Survey of Frontiers in Solid Mechanics and a Celebration  
of Dan Drucker's Contributions to the Engineering Profession**

The symposium will be sponsored by the University of Florida to honor the late Graduate Research Professor Emeritus Daniel C. Drucker. **Friends of Dan Drucker, and all individuals interested in his works are cordially invited to attend.**

*Part 1 – A survey of modern frontiers in solid mechanics.* **Jim Rice** will initiate the session, other speakers will be **Mary Boyce, Rod Clifton, Ben Freund, John Hutchinson, Rick James, Sia Nemat-Nasser, and Rob Phillips.**

*Part 2 – Papers by Dan's former Ph.D. students.* **George Dvorak** will lead the session, which will include talks by **Wai-Fah Chen, Dixon Dudderar, Ming Li, Giulio Maier, Dave McDowell, Andrew Palmer, and Jim Sirkis.**

*Part 3 – Dan Drucker's contributions to the engineering profession.* **Karl Pister** will be the leadoff speaker, followed by **Nick Cristescu, Jim Dally, Carl Larson, Tinsley Oden, Simon Ostrach, Bhavani Sankar, and Bill Sharpe.**

The **2002 ASME Daniel C. Drucker Medal** will be presented to **George Dvorak** at the banquet on October 9<sup>th</sup>. The **Drucker Family** and longtime friends of Dan will be invited as honored guests.

**There will be no registration fee for the meeting or the reception, banquet and luncheons.** All sessions will be held at the University of Florida Hotel & Conference Center; a special room rate of \$95 per night, single or double, has been arranged for all participants. For further information, please visit the following website: <http://aero.ufl.edu/DruckerSymposium>, or contact Gene Hemp.

**Gene Hemp**, Local Arrangements Chairman  
Dr. Daniel C. Drucker Memorial Symposium  
231 Aerospace Engineering Building  
University of Florida  
Gainseville, FL 32611-6250  
E-mail: [ghemp@ufl.edu](mailto:ghemp@ufl.edu)

*Organizing Committee:* Ben Freund, *Chairman*, Chuck Taylor, *Co-Chairman*, Dick Christensen, George Dvorak, Gene Hemp, Jim Rice, Dick Shield

## **FOURTH INTERNATIONAL SYMPOSIUM ON VIBRATIONS OF CONTINUOUS SYSTEMS**

The Fourth International Symposium on Vibrations of Continuous Systems will take place in Keswick, England, July 7-11, 2003. The primary goal of this Symposium is to bring together outstanding experts in the field of vibrations of continuous systems from all over the world, to discuss technical topics in a very informal atmosphere. As before, participation will be by invitation only, and will be limited to maximum numbers of 50 participants and 40 presentations.

The Symposium is devoted to the vibrations of continuous systems (e.g. strings, rods, straight and curved beams, membranes, plates, shells, and three-dimensional bodies). Examples of topics to be considered include: free and forced vibration, linear and nonlinear vibration, undamped and damped vibration, fluid-structure interaction, and structural elements of composite material.

The Symposium location, Keswick, is in the heart of the Lake District of northwestern England, famous for its beautiful lakes and hills. Typical days at the Symposium will consist of morning hikes or bus excursions, presentation sessions in the afternoons, and social gathering times in the evenings. The outings and social gatherings have proved to be excellent ways of generating relaxed and informal technical discussions and friendships which have been of great value to ongoing research.

Individuals who are interested in taking part in this Symposium should write to:

Professor Arthur W. Leissa  
General Chairman, ISVCS IV  
Dept. of Mechanical Engineering  
206 West 18<sup>th</sup> Ave.  
Ohio State University  
Columbus, Ohio 43210  
USA

Letters should be accompanied by a one-page summary of the writer's research accomplishments (include a list of published books, papers, reports, etc.) in the theme of this Symposium.

**CALL FOR NOMINATIONS  
FOR DIRECTOR OF REGION IB,  
CENTRAL AND WESTERN USA**

Nominations are called for Director of Region IB, Central and Western USA, for a three-year term of service commencing in June 2003. The nominee must be an active Member of the Academy registered in that region; and nominations shall be accepted only from active Members resident in that region. Valid nominations must bear the signatures of five (5) Members of the Academy who are residents of the region and are Members in good standing. Nominations shall include a letter from the nominee accepting the nomination. The deadline for submissions is September 30, 2002. Early nominations are strongly encouraged.

Please submit all nominations to

Professor Dean Mook, Secretary  
American Academy of Mechanics  
Department of Engineering Science and Mechanics  
Virginia Polytechnic and State University  
Blacksburg, VA 24061-0219

**CALL FOR NOMINATIONS  
FOR DIRECTOR OF REGION III,  
CENTRAL AND SOUTH AMERICA**

Nominations are called for Director of Region III, Central and South America, for a three-year term of service commencing in June 2003. The nominee must be an active Member of the Academy registered in that region; and nominations shall be accepted only from active Members resident in that region. Valid nominations must bear the signatures of five (5) Members of the Academy who are residents of the region and are Members in good standing. Nominations shall include a letter from the nominee accepting the nomination. The deadline for submissions is September 30, 2002. Early nominations are strongly encouraged.

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**SELECTIONS OF THE EDITOR****What You Need to Know About Pre-Assignment Agreements to Protect Your Intellectual Property**

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*Vol. 26, No.8, August 2002*

By Dr. Robert J. Kuntz, P.E.

The only specific right the U.S. Constitution grants to citizens is ownership of their intellectual property (Article I, Section 8, Clause 8).

But employees now working for technical companies, academic institutions and government likely signed a contract that pre-assigned their intellectual property to their employers.

Most engineers initially learn about pre-assignment agreements when hired. The agreements require employees to confidentially disclose their discoveries to their employers, who determine whether they will be treated as trade secrets, submitted for patents, copyrighted or buried in corporate proprietary files. Past studies indicate that only one of every 10 disclosures results in a patent application. The other nine may never see the light of day for several reasons. This does not account for discoveries never disclosed.

The contract also probably contained a "trailing clause" that transcends termination of service for a specified time. These clauses can be barriers to future employment because of the agreement's non-compete covenants -- making engineers with highly specific expertise unemployable in an open job market.

Employers say they should own an employee's intellectual property because they pay a salary and provide infrastructure and resources. Those against pre-assignment call these agreements "adhesion contracts," because they are unilateral, signed under duress (no signature means no job) and predispose a Constitutional right.

Moderates believe that a "shop right" approach is fair. This term is derived from English common law, in which a business owner or employer has a non-exclusive, license-free use of an employee's invention, but the inventor retains title rights for all other uses.

The U.S. Department of Defense (DoD) is one such organization that retains a shop right for inventions that are first conceived or reduced to practice under a DoD contract. The contractor or employer retains title rights for all other uses, limited by national security regulations.

The issue of employee inventor's rights was considered in the U.S. Congress, but without resolution.

Nearly 30 years ago, in the 87th Congress, the subcommittee on Patents, Trademarks and Copyrights questioned how corporations could demand patent rights in addition to monetary compensation from the DoD when they do not practice that policy in their own employment

contracts. Admiral Hyman Rickover addressed the subcommittee and tied employed inventors' incentives to the Constitution's intent.

He said the law should be changed "to increase incentives for employed inventors who get no benefit whatsoever out of the patent system as it has evolved. We might consider whether we ought not to go back to the original intent of the Constitution and devise some reward for inventors, whether they are government or industry employees." The latter is now a reality as a result of the 1986 Federal Technology Transfer Act affecting employees of government-owned and government-operated laboratories.

In 1963, California Congressman George Brown introduced legislation to make pre-invention assignment agreements an unfair labor practice. The bill never received a hearing.

In 1970, Congressman John E. Moss introduced a bill that covered both "service inventions," which relate directly to an employee's job assignment, and "free inventions," which are not related to the employee's job assignment and done on their own time with their own resources. He introduced successive bills; the last was in 1977. All were referred to the Subcommittee on Intellectual Property of the House Judiciary Committee, but none were heard.

California, Delaware, Illinois, Kansas, Minnesota, North Carolina, Utah and Washington have pre-invention assignment law in their labor codes. Some laws broadly define the scope of assignment agreements to include any intellectual property that "relates to the business of the employer, to the employer's actual or demonstrably anticipated research or development, or which results from any work performed by the employee for the employer."

Employers believe they must protect their interests, but employee inventors think the statement is so broad that a diversified corporation can take ownership of almost any invention, nullifying the law's purpose. Because intellectual property is a federal matter, most researchers believe legal conditions affecting ownership fall under federal jurisdiction. Employers believe they must protect their interests, but employee inventors think the statement is so broad that a diversified corporation can take ownership of almost any invention, nullifying the law's purpose. Because intellectual property is a federal matter, most researchers believe legal conditions affecting ownership fall under federal jurisdiction.

Questions still remain. Does the common U.S. business practice of pre-assignment carry out the Constitutional purpose -- "promote the progress of science and useful arts" -- or is it an impediment to America's ability to compete in the global marketplace? Is national economic development and trade balance a matter of national security?

This should be the basis for any debate on the pre-assignment of intellectual property issues. Rights of inventors and employers are important, but the Constitutional purpose establishing intellectual property transcends.

*Dr. Kuntz has conducted extensive research for more than four decades on invention, innovation and intellectual property.*

## Linking with Light

*Reprinted with permission from Spectrum*

*August 2002*

By Neil Savage

*Having proven their worth in long-distance communications, photons will soon take over inside the computer*

The movement of data in a computer is almost the converse of the movement of traffic in a city. Downtown, in the congested core of the microprocessor, the bits fly at an extraordinary rate. But further out, on the broad avenues of copper that link one processor to another and one circuit board to the next, things slow down to a comparative crawl. A Pentium 4 introduced this spring operates at 2.4 GHz, but the data travels on a bus operating at only 400 MHz. The speed picks up again, though, out on the highways of the world's optical-fiber telecommunications networks. Obviously, the closer engineers can bring the optical superhighway to the microprocessor, the fewer copper bottlenecks can occur, as if you could pull out of your driveway straight onto the Autobahn.

So some researchers say that, within just a few years, many of the copper connections in computers will yield to high-speed optical interconnects, in which photons, rather than electrons, will pass signals from board to board, or chip to chip, or even from one part of a chip to another [see illustration].

The idea is simple in principle, and parallels telecommunications systems. An electrical signal from the processor would modulate a miniature laser beam, which would shine through the air or a waveguide to a photodetector, which would in turn pass the signal on to the electronics. Though at the moment it is more expensive to communicate with light than with electric current, the day is coming when only optical technologies will be able to keep up with the demands of ever-more-powerful microprocessors, just as they are now the only reasonable way to move the world's Internet traffic across the kilometers.

"We're already projecting that for certain system requirements data rates are going to be high enough and the link length long enough that we're going to have to use optics," says Modest Oprysko, senior manager of communications technologies at IBM Corp.'s Thomas J. Watson Research Center (Yorktown Heights, N.Y.).

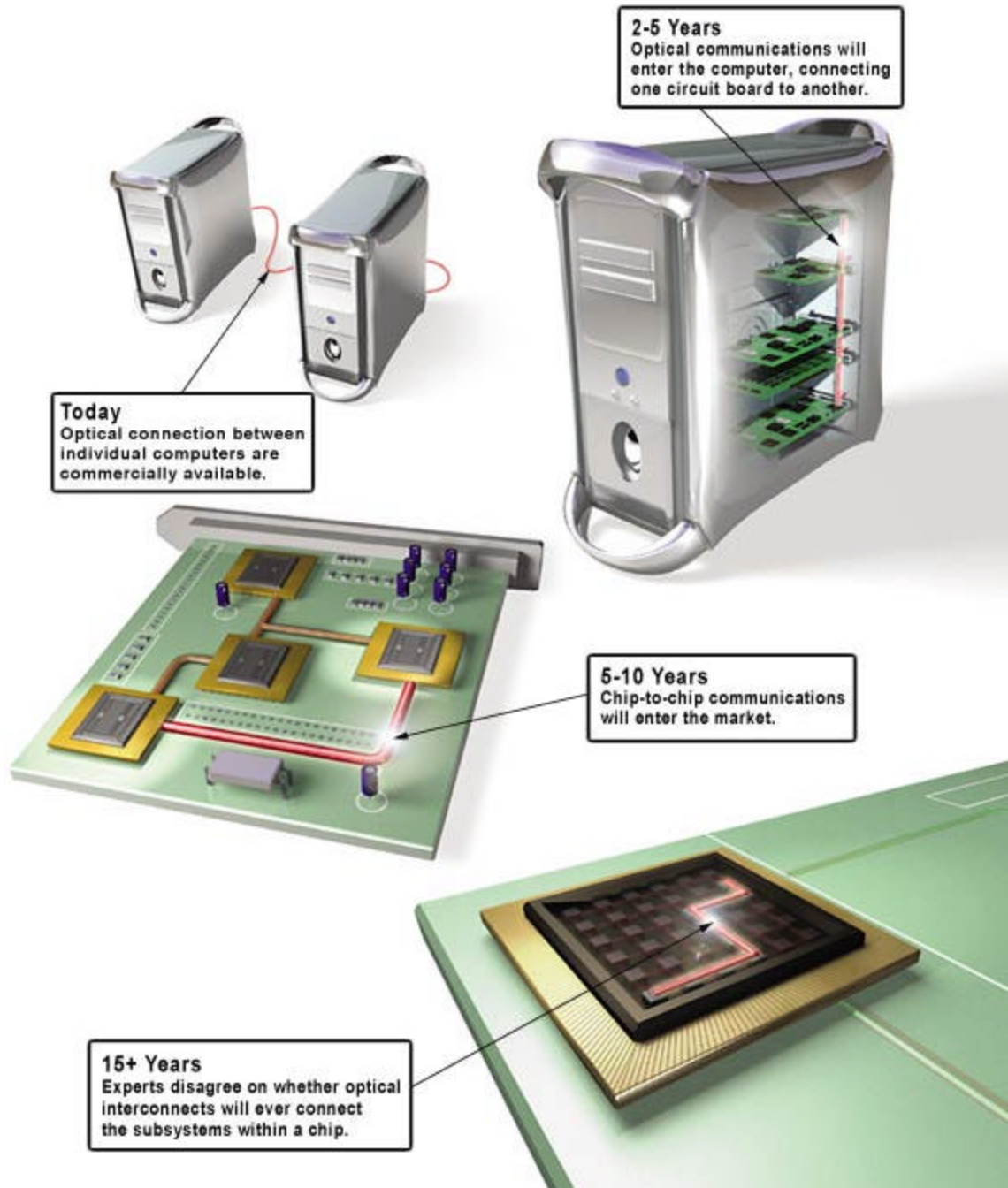
A wire's bit rate is at the mercy of its parasitic resistance, capacitance, and inductance. At low frequencies, the series resistance and shunt capacitance of a circuit board trace dominate its behavior, determining the transition (rise and fall) times and thereby limiting its data rate. At higher frequencies, like those on circuit boards today, the wire's series inductance becomes more important than its resistance as an impeding factor, but with the same end result—a limit on the rate at which the trace can transmit pulses.

All these parasitic factors depend heavily on the geometry of the wire, especially its length. Resistance, for instance, is proportional to the wire's length and inversely proportional to its cross-sectional area. Because of this dependence on geometry, a simple wire's ultimate bit rate turns out to be proportional to its cross section, but falls with the square of its length. So

thinner—and especially longer—means a lower bit rate. On a chip, the story has some caveats, but the conclusion is the same.

### Coming Soon: Optical Interconnects

This approach to signal transfer is moving from longer-distance applications, such as linking separate computers, to joining chips within a computer.



Transition-time limitations can be fought by driving the lines harder, but that's not a very good solution. It adds noise, increases power requirements, and aggravates already serious thermal management problems. Alternatively, the wires can be made fatter, but then you'll run out of

space. Photons don't suffer from these limitations; their biggest problems are absorption and attenuation, neither of which is an issue over the distances inside a computer, or even across a room.

In telecommunications, transmission slows as it passes from the all-optical long-haul network to the lower-bandwidth metropolitan-area network, and finally crawls into the home along copper wires. Just as telecom companies want to increase total bandwidth by moving all-optical transmission closer to your house, the designers of optical interconnects want to get as much bandwidth as possible as close as possible to the microprocessor. Already, optics connect computer systems across distances of less than 300 meters, and backplane setups are in the works that will speed up transport of data from one board to another within a computer. Farther down the road are systems for increasing the bandwidth between two microprocessors, or among stacks of chips for massively parallel computing. All the pieces are in place—cheap lasers, sensitive detectors, and the methods needed to transmit from one to the other. Now it's just a question of when optical interconnects will perform well enough, and their production cost fall low enough, for them to replace copper wires.

### **Thinking inside the box**

Many developers of optical interconnect schemes funnel the signal through some kind of waveguide. For instance, DaimlerChrysler Research (Ulm, Germany) is developing waveguide-based optical backplanes to connect computers in an airplane or to route signals in computers used in telecommunications [see figure]. As in most optical interconnect schemes, the photons are generated by vertical-cavity surface-emitting lasers (VCSELs) [see "Arrays of Light"]. Light passes through a lens, which expands the beam to a few millimeters in diameter. The expanded beam hits the waveguide entrance with greater certainty, while at the waveguide exit, it is redirected by a mirror through another lens, which focuses it on a detector. DaimlerChrysler claims the polymer waveguide is easier to integrate into a system than an optical fiber.

Prototypes with data rates of 1 Gb/s per channel across distances less than 100 cm were successfully tested last March. The company is providing development samples with channel rates of 2.5 Gb/s, and has systems with 10-Gb/s channels under development in the laboratory.

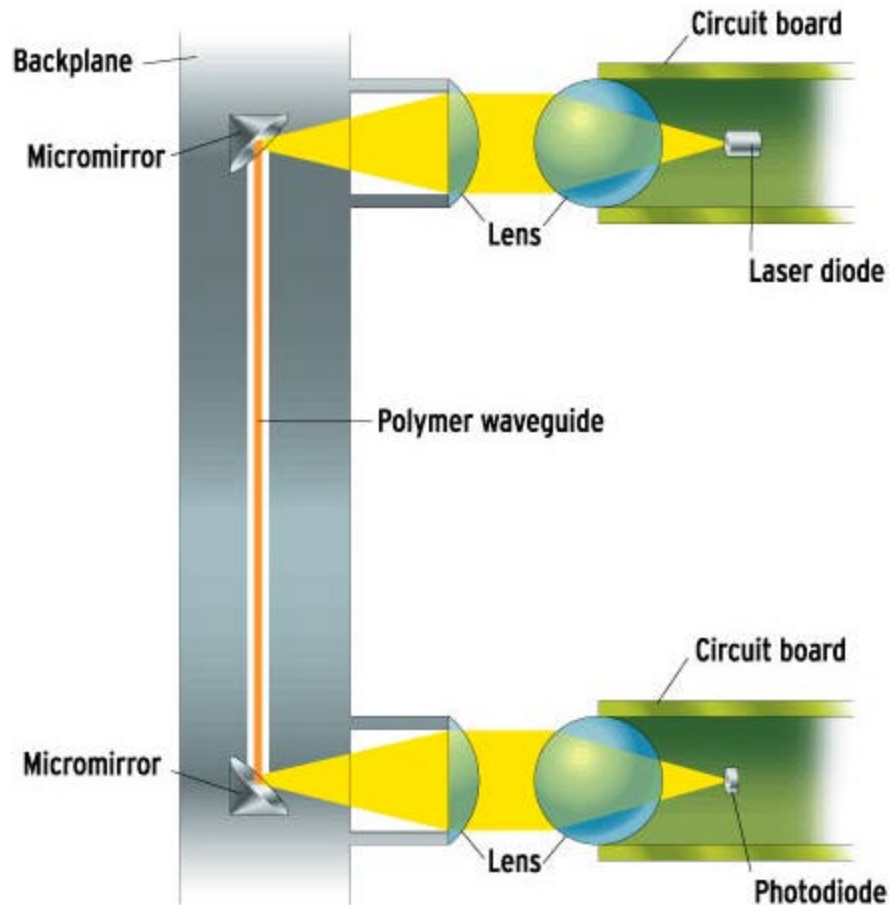
Another waveguide-based scheme belongs to two-year-old Primarion Corp. (Tempe, Ariz.). The company is in the early stages of making optical circuits that transmit data at 10 Gb/s across short distances. The goal is to bring fiber all the way to the processor. In its design, an electrical signal travels across a circuit board to a laser driver chip, which processes the signal and prepares to send it out. Connected to the laser driver is another module, containing an array of 12 VCSELs. The laser beams travel across optical fibers to a similar setup on another board, and there a photodetector passes the signal onto a receiver chip for reprocessing and conversion back into electricity.

John Burns, Primarion's vice president of technology development, sees compact optical I/O devices within the computer in just two to three years' time. These would combine the processing circuitry and the laser or receiver into a single package, with electrical contacts on the bottom and fiber-optic sockets on the side. Eventually, the company envisions having a printed optical board, like a printed-circuit board but embedded with polymer waveguides in place of copper wires. Then the signal-processing circuitry could sit right next to the device that needed the data,

and the signal would be transmitted through the circuit board as light, minimizing the time data spends as electrons.

### Optical Backplanes Speed Data

In DaimlerChrysler's optical backplane, the beam from a laser diode passes through one set of lenses and reflects off a micromirror before reaching a polymer waveguide, then does the converse before arriving at a photodiode and changing back into an electrical signal. A prototype operates at 1 Gb/s.



### Arrays Of Light

Most optical interconnect schemes envision using vertical-cavity, surface-emitting lasers (VCSELs) as their light source along with one of two types of semiconductor detectors. All three technologies use III-V materials like gallium arsenide rather than silicon, and so cannot be directly integrated with the silicon CMOS devices with which they communicate. Nonetheless, developing silicon CMOS-based lasers and detectors is an active research area that could smooth the introduction of optical interconnects.

Many detector designs use p-i-n photodiodes, a sandwich of p-type, intrinsic, and n-type semiconductor material that generates current when struck by a photon. A sandwich of metal-semiconductor-metal creates MSM photodetectors that work much the same way, at a higher speed than p-i-n photodiodes but with less sensitivity. Researchers use both in their designs, depending on which attributes are most important to them.

GaAs VCSELs have been commercially available for the last few years. The devices are diode lasers that, unlike most used in long-haul telecommunications, emit from the surface of the laser rather than the edge,

so they can be placed on top of a chip. It's relatively easy to build an array of hundreds or thousands together in a plane and to make them close to the size of transistors, a few hundred nanometers across. A small percentage of the individual VCSELs in an array, however, may not work properly. Bond a bum array to an expensive microprocessor and you've wasted a lot of money, so if optical interconnects are to take off, VCSEL manufacturers must reduce the failure rate.

As chips continue to shrink, transistors are squeezed closer together, as would be the VCSELs communicating with them. Such spacing raises the specter of a problem shared with electrical wires: as they get closer and operate at higher rates, the threat of electrical interference between adjacent channels increases. Though the light from the lasers itself isn't subject to crosstalk, the electric current that drives it is.

The power driving the VCSELs also creates heat, which is worse for the lasers than for electronic circuitry. As the GaAs heats up, its material properties change, and the lasers can detune, wandering to a different wavelength. Beyond about 80 °C they stop working altogether. So the challenge is to increase their efficiency so they can be driven at even lower powers.

Perhaps the biggest difficulty with VCSELs is that the GaAs, and in fact any lasing semiconductor, has a lattice that doesn't match with silicon's. That means they have to be manufactured in a separate process, adding enormously to production expense. They can be bonded to CMOS chips, but they will undergo thermal expansion at a different rate from the silicon, stretching out of alignment or even breaking the device. The photodetectors are also based on GaAs, so they suffer from the same drawbacks, although some researchers are looking into silicon-based detectors.

Naturally, optoelectronics engineers would love to make VCSELs from silicon, but the material doesn't emit light easily. Unlike such semiconductors as GaAs, silicon has an indirect band gap, making a free electron more likely to give up its energy as heat than to combine with a hole and emit a photon.

### **Glimmer of hope**

But Wilfred Pinfold, technology director of Intel Corp.'s microprocessor research laboratory, sees some hope in work last year from Britain and Australia. In March 2001, Kevin Homewood of the University of Surrey (Guildford, England) reported success in making a silicon light-emitting diode (LED). He achieved this by bombarding the silicon with boron ions. These created barriers in the silicon lattice that trapped electrons in a small area, increasing their likelihood of finding holes to combine with.

Last August, Martin Green of the University of New South Wales (Sydney, Australia) reported a new silicon LED. The device has inverted pyramids etched into it that reflect some emitted photons back into the silicon, where they can stimulate further emission. It converted electrons to photons with 1 percent efficiency—very low, but 100 times that of previous silicon LEDs.

LEDs, unfortunately, are not as useful as more powerful, more focused lasers. And, after decades of struggle, some researchers are skeptical of silicon's chances. "If God wanted ordinary silicon to efficiently emit light, he would not have given us gallium arsenide," says Elias Towe of Carnegie Mellon University (Pittsburgh).

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Fiber-based interconnects have already made their commercial debut, but not yet within the computer itself. In late 2000, Agilent Technologies (Palo Alto, Calif.) started selling an optical connector to link computers up to 300 meters apart. Developed with Anthony F. J. Levi, head of the Advanced Interconnect and Network Technology program at the University of Southern California (USC, Los Angeles), one version of the plug-in package can transmit data at an aggregate rate of 10 Gb/s. It contains four transmitters and receivers and connects via four

optical fibers to a similar package. A 12-channel version operates at up to 40 Gb/s, but transmits in only one direction at a time. Other companies now offer similar products, for use in rack-to-rack connections among servers, in data storage centers, and in network and telecom switching.

Agilent's next aim, according to David Dolfi, manager of its optical interconnects and networks department, is to do something similar for a backplane within a computer. To keep up with faster processors and more complex systems, he says, the bandwidth of backplanes must increase by an order of magnitude, and that will require optical links. Barring some breakthrough in electrical links, Dolfi expects optical interconnects to move inside the box in three to five years.

## **Through the air in there**

While the nearer-term, less complex interconnect schemes deliver light through a waveguide, engineers interested in high-performance computing are developing chip-to-chip optical communications through the air. So-called free-space interconnects could boost data throughput between chips by a factor of a thousand. This increase stems from the combination of the high data rate of optics and the fact that optical data channels can be much more densely packed than electrical ones. For one, the channels can be formed into two-dimensional arrays, rather than the one-dimensional packing of copper or optical fiber interconnects on a board. Secondly, the channels do not experience crosstalk when close together.

One such system in which three stacks of 16 chips apiece can talk to each other optically has been developed by Sadik Esener, a professor of electrical engineering at the University of California, San Diego, and his colleagues. A 16-by-16 array of VCSELs send a beam through the air, where integrated microlenses focus the beam and diffraction gratings redirect it. The result is a tight, 3-D array of highly interconnected chips for supercomputing and other applications [see figure].

Most researchers see such free-space interconnects as farther off in the future than those that use fiber to guide the light, in part because they require an accuracy of alignment much greater than that of plug-in cards in the average desktop. And anyone who has ever opened up a home computer and seen the dust built up inside knows another of the obstacles.

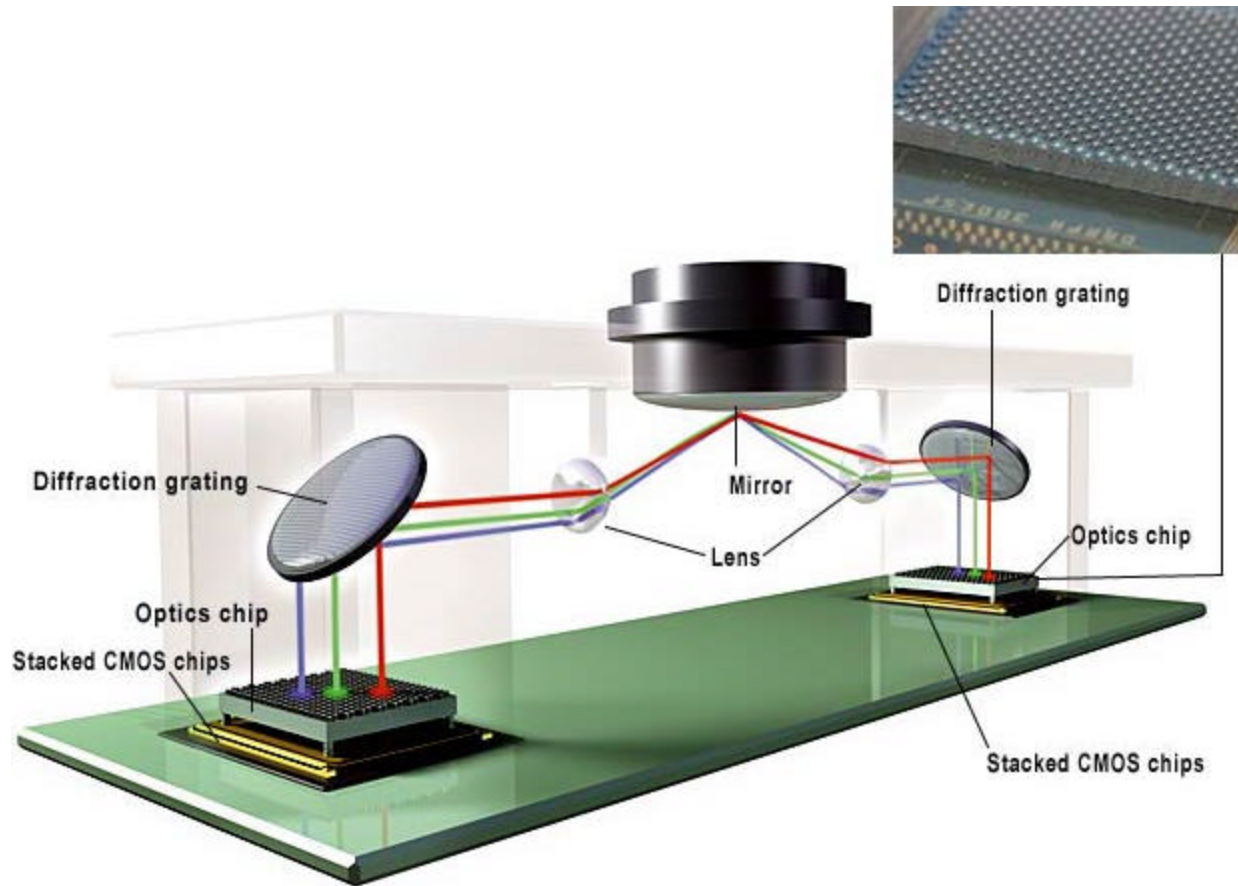
Nonetheless, free-space optics intrigues engineers who think about doing computing in revolutionary ways, and it has been an active research area for high-performance computing in North America, Japan, and especially Europe, which has had a longstanding effort. The appeal is simple. Say you wanted a supercomputer that could be optimized for multiple tasks. You set up the processors to work best with a given algorithm, perhaps for image processing, but when you want to switch to weather modeling, the architecture is no longer ideal. Using free-space optical interconnects, you could reconfigure the way processors talk to one another by redirecting the lasers to different detectors.

John Neff, director of the Optoelectronic Computing Systems Center at the University of Colorado (Boulder), is working on microelectromechanical systems (MEMS) that might be used to steer the beams. In Neff's experimental system, a microscopic mirror is attached to two metals with different thermal properties. Heat them up by running current through them, and one will stretch more than the other, bending it in the desired direction. It's a slow process, however, and

the highest switching speed is about a kilohertz. But using electrostatic repulsion instead of heat to bend the mirrors produced speeds of 10 kHz, and Neff thinks he can get that up to 100 kHz.

### Free-Space Interconnects Pack in Data Channels

An experimental module from the University of California, San Diego, just 2 cm high, connects stacks of CMOS chips. Each stack is topped with an optics chip [below center] consisting of 256 lasers (VCSELs) and photodiodes. Light from the VCSELs makes a vertical exit from one stack [below, left] and a vertical entry into the other. In between it is redirected via a diffraction grating, lenses, an alignment mirror [center], and another grating. Each of the device's 256 channels operates at 1 Gb/s.



### Up for debate

The exact point at which the economics of moving data dictate optical interconnects is debatable. According to USC's Levi, when microprocessors reach speeds of 10 GHz, their inability to communicate quickly with computer memory or with other chips in a multiprocessor system will start to stifle their usefulness. "At that point, [it will be] increasingly difficult...for Intel to make useful systems out of those processors," Levi said.

Naturally, Intel Corp. is loath to sound the death knell for electrical interconnects quite yet. Says Wilfred Pinfeld, technology director in its microprocessor research laboratory, "We still see a lot of opportunity to continue to move copper signaling forward."

For a start, engineers could rework the architecture of chips and boards to shorten the distances over which signals have to travel. Designers could add more pins to increase the number of I/O links, though not indefinitely. Intel can move data at 10 GHz over a copper wire on the board, and should be able to push that to at least 20 GHz. Pinfeld says: "Where that peters out, we don't know." Still, his lab is striving for advances in both electrical and optical interconnects, as are IBM, Advanced Micro Devices, and other competitors.

Much of the research into optical interconnects in the U.S. has been funded by a US \$70 million program run by the U.S. Defense Advanced Research Projects Agency (DARPA, Arlington, Va.). The massively parallel computing systems it has in view could find use in modeling nuclear reactions. But Ravindra Athale, who oversees the research, expects it to filter down to the consumer as well. The progression should be from expensive, intensive computer systems to simpler, cheaper ones, as well as from longer to shorter distances. Rack-to-rack connections are already here, board-to-board links seem likely in a few years, and chip-to-chip interconnects may happen in a decade or so.

As for optical connections between one system and another on a single chip, the view of most experts is dim. "It think that's beyond what's viable given today's technology," says USC's Levi. But finding out whether cross-chip optical interconnects will ever be practical is one of the reasons for advanced research, says DARPA's Athale. "The answer is maybe, and that's final."



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