MÜHENDİSLİĞİN UFUKLARI SEMPOZYUMLARI
ULUSAL MÜHENDİSLİK AKADEMİSİ'NİN [A.B.D.] UFUK AÇAN MÜHENDİSLİK RAPORLARI
ANNUAL SYMPOSIA ON FRONTIERS OF ENGINEERING: REPORTS ON LEADING EDGE ENGINEERING
NATIONAL ACADEMY OF ENGINEERING

Derleyen[*]
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Amerika Birleşik Devletleri'nde mühendisliğin yeni ufuklar açan alanlarında yapılan çalışmaların önceden belirlenmiş başlıklar altında sempozyum formatında sunulması, NAE Council (Ulusal Mühendislik Akademisi Konseyi) tarafından *"The Frontiers of Engineering Symposium – Mühendisliğin Ufukları Sempozyumu"* başlığı ile 1994 yılında başlatıldı. İlk sempozyum Eylül 1995'te düzenlendi. Aslında bu düşünce *"National Academy of Sciences - Ulusal Bilimler Akademisi"nin* 30-45 yaş grubundan bilim insanlarının çeşitli disiplin alanlarında erişilen son noktaların tartışılması amacıyla biraraya getirilmesi programından esinlenmişti. Sempozyum her yıl üstün başarılı 100 genç mühendisi önceden belirlenmiş alanlarda uç noktalarda yaptıkları araştırmaları ve yenilikleri (inovasyon) paylaşmaları amacıyla biraraya getirmektedir. Katılımcılar arasında etkileşimi ve bilgi alış verişini ençoklaştırabilmek için katılım 100 genç mühendisle sınırlı tutulmaktadır. Katılımcılar rekabetçi bir adaylık ve seçme süreci sonunda belirlenmektedir.

Mühendislik uygulamaları sürekli olarak değişmektedir. Mühendislerin hızla gelişen teknolojik değişimlerin gerçekleştiği bir zamanda başarılı olmalarının yanı sıra disiplinlerarası takımlarda da çalışabilmeleri gerekmektedir. Günümüzün yeni ufuklar açan araştırmaları mühendislik disiplinlerinin arakesitinde yapılmakta olduğundan başarılı araştırmacıların ve uygulamacıların kendi alanları dışındaki gelişmeler ve sorunlardan da heberdar olmaları gerekmektedir. Sempozyum, gelecek vadeden bireylerin birbirleriyle ilişki kurmalarını ve öğrenmelerini özendirmek üzere tasarlanmıştır. Bu ağyapı yeni tekniklerin ve yaklaşımların aktarılmasına, işbirliğine dayalı çalışmalara ve ABD'nin yenilik kapasitesini destekleyecek fikirlerin ve uygulamaların yaratılmasına olanak sağlamaktadır.

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[*] Sempozyum raporlarının sunuş bölümünde yer alan açıklamalardan ve **FRONTIERS OF ENGINEERING** sitesinden derlenmiştir.

Sempozyumun dört ana başlığı ve çağrılacak konuşmacılar yine 30-45 yaş grubundan katılımcıların oluşturduğu düzenleme komitesince belirlenmektedir. Alanlarının uzmanı olan konuşmacılar karşılaştıkları güçlükleri ve çalışmalarının ilgi çekici yanlarını, teknik yönleri çok gelişkin ancak sunulan konunun uzmanı olmayan bir dinleyici grubuna açıklarlar. Araştırmalarını özetleyerek, bu alanda ulaşılan sınırları tanımlayıp deneylerini, prototiplerini ve tasarım çalışmalarını (tamamlanmış veya süren) açıklarlar. Bunun yanı sıra yeni araç ve yöntemleri, kısıtları ve çelişkileri ve uzun erimde çalışmanın önemini değerlendirirler.

Aşağıda yer verilen **Tablo I**'den bu sempozyumların programları aracılığıyla, 1995 yılından bu yana gündeme gelen mühendislik ufkunu açıcı konuların neler olduğu topluca görülebilir. Aynı tablo üzerinden her sempozyumun bilgilerine ve sonuçta ortaya konan "**Ufuk Açan Mühendislik Raporları**"na erişilebilir.

Tablo II'den de, söz konusu sempozyumların ayrıntılı programlarına ve bu programlar üzerinden de sunucuların büyük çoğunluğunun hem bildiri hem de yaptıkları sunuşlarına erişilebilmektedir.

Table I
ANNUAL SYMPOSIUMS ON U.S. FRONTIERS OF ENGINEERING: REPORTS ON LEADİNG EDGE ENGİNEERİNG
NATIONAL ACADEMY OF ENGINEERING

HELD IN	PROGRAM OF THE SYMPOSIUM	PDF
1995 NAE, Washington, DC September 21-25	**Frontiers of Engineering: Reports on Leading Edge Engineering from the 1995 NAE Symposium on Frontiers of Engineering** **ADVANCES IN BIOTECHNOLOGY** **Advances İn Bioprocessing for New Molecules in Medicine** *Directed Evaluation: Creating Biocatalysts for the Future,* Frances H. Arnold *Engineering of Large Cell Cultures,* John G. Aunins **Advances in Materials And Optics for Medicine** *Engineering Self-Assembling Systems for Delivery of Biological Agents,* AlanS. Rudolph *Optical Spectroscopy for Diagnosis of Disease in Tissue,* Rebecca Richards-Kortum **DESIGN AND MANUFACTURING OF COMMERCIAL PRODUCTS** **Design of Materials, Products, and Processing from Nano to Macro Scales** *Design Process and New Design Tools,* David C. Gossard *Designer Materials Through Nano Processing,* Jackie Y. Ying *Intelligent Design of Casting Operations,* Jamal Righi *Large-Scale Systems Integration,* Patrick M. Sanahan **ENGINEERING IN THE URBAN ENVIRONMENT** **Innovative Treatment of Hazardous Toxic, and Radioactive Wastes** *Biological Treatment of Hazardous Waste,* Joseph B. Hughes *Novel Chemical Processing of Hazardous Waste,* Christopher J. Nagel	**Reports 1995** **Read-only**

		Urban Air Quality and the Automobile	
		Mobile Source Emission and Air Quality, David L. Hofeldt	
		The Hybrid Electric Vehicle, David Brigham	
		INFORMATION TECHNOLOGY	
		Internetworking	
		Distributed Computing, David A. Patterson	
		Communication and Information on the Internet, Anita Borg	
		Ultrahigh Bandwidth Communication	
		Next-Generation Subscriber Access Networks, T. F. Darcie	
		Semiconductor Lasers and Optical Communications, Kam Y. Lau	
1996 September 19–21, Beckman Center of the National Academies in Irvine, California		**Frontiers of Engineering: Reports on Leading Edge Engineering from the 1996 NAE Symposium on Frontiers of Engineering** **DESIGN RESEARCH** *Designing Vehicles in Changing Times,* Connie L. Gutowski *Development of Performance-Based Seismic Design Procedures,* Sharon L. Wood *Information in the Design Process,* Alice M. Agogino *Product Modularity: A Key Concept in Life-Cycle Design,* Kosuke Ishii **VISUALIZATION FOR DESIGN AND DISPLAY** *Visualizing Aircraft Aerodynamic Design,* Steve Bryson *Virtual Reality and Augmented Reality in Aircraft Design, and Manufacturing,* David W. Mizell *The Frontiers of Virtual Reality Applied to High Performance, Computing and Communications,* Maxine D. Brown *Digitizing the Shape and Appearance of Three-Dimensional Objects,* Marc Levoy	[Reports 1996](#)

	MICROELECTROMECHANICAL SYSTEMS *Microelectromechanical Systems (MEMS),* Kaigham J. Gabriel *Fabrication Technology and the Challenges of Large-Scale Production,* Karen W. Markus *Frontiers in MEMS Design,* Kristofer S. J. Pister *Large-Market Applications of MEMS,* Eric Peeters **INNOVATIONS IN MATERIALS AND PROCESSES** *Cellular Materials: Structure, Properties, and Applications,* Lorna J. Gibson *Silicon Satellites,* Siegfried W. Janson *Novel Ceramic Ferroelectric Composites,* Louise C. Sengupta *Co-Continuous Composite Materials from Net-Shape Displacement Reactions,* Glenn S. Daehn	
1997 Beckman Center of the National Academies in Irvine, California September 18–20	**Frontiers of Engineering: Reports on Leading Edge Engineering from the 1997 NAE Symposium on Frontiers of Engineering** **BIOMECHANICS** *Overview,* Janie M. Fouke *Biomechanics of Cells and Cell-Matrix Interactions,* Farshid Guilak *Mechanical Influences on Bone Development and Adaptation,* Marjolein C. H. van der Meulen *Implant Design and Technology,* Avram Allan Edidin **SENSORS AND CONTROL FOR MANUFACTURING PROCESSES** *Emerging Control Structures,* Angela L. Moran *Design and Applications of Optical Fiber Sensors,* Kent A. Murphy *Process Control for Chemical Production: An Industrial Success Story,* Babatunde A. Ogunnaike **SAFETY AND SECURITY ISSUES** *Air Traffic Control Modeling,* Kathryn T. Heimerman *Quadrupole Resonance Explosive Detection Systems,* Timothy Rayner	**Reports 1997** **Read-only**

		The Role of Nondestructive Evaluation in Life-Cycle Management, Harry E. Martz *Challenges of Probabilistic Risk Analysis*, Vicki M. Bier **DECISION-MAKING TOOLS FOR DESIGN AND MANUFACTURING** *Variation Risk Management in Product Development,* Anna C. Thornton *Multicriteria Evaluation of Manufacturing Performance,* Angela Locascio **INTELLIGENT TRANSPORTATION SYSTEMS** *Intelligent Information for Transportation Management,* Christopher M. Poe *Automated Highway Systems,* Akash R. Deshpande	
	1998 NAE, Washington, DC September 17–19	**Frontiers of Engineering: Reports on Leading Edge Engineering From the 1998 NAE Symposium on Frontiers of Engineering** **BIOMATERIALS AND OPTICAL IMAGING FOR BIOMEDICINE** *Integration of Molecular and Macroscopic Scales in Tissue Engineering*, Linda G. Griffith *Artificial Proteins: Bridging the Gap Between Natural and Synthetic Macromolecular Materials,* David A. Tirrell *Biomedical Imaging Using Optical Coherence Tomography,* James G. Fujimoto *Confocal Reflectance Microscopy: Diagnosis of Skin Cancer Without Biopsy?* Milind Rajadhyaksha **ADVANCED MATERIALS** *Trends in Computational Materials Science for Materials Design and Processing,* Sharon C. Glotzer *Design, Synthesis, Development and Integration into Manufacturing of New Polymer Materials Architectures for Advanced Integrated Circuit Fabrication,* Omkaram Nalamasu *Novel Sheet Steel Developments,* John G. Speer **SIMULATION IN MANUFACTURING** *Role of Simulation in the Design of Next-Generation Engines for Military Aircraft,* Mark N. Glauser *Role of Simulation in Understanding Surface Roughness in Formed Aluminum Parts*, Armand J. Beaudoin *Machine Performance Assessment Methodology and Advanced Service Technologies,* Jay Lee	[Reports 1998](#)

	ROBOTICS *A Brief History of Robotics,* Kenneth Y. Goldberg *Algorithms in Robotics: The Motion Planning Perspective,* Lydia E. Kavraki *Mechanics, Control, and Applications of Biomimetic Robotic Locomotion,* Joel W. Burdick *Robotic Perception for Autonomous Navigation of Mars Rovers,* Larry H. Matthies Cobots 105 Michael A. Peshkin	
1999 Beckman Center of the National Academies in Irvine, California October 14–16	**Frontiers of Engineering: Reports on Leading Edge Engineering from the 1999 NAE Symposium on Frontiers of Engineering** **DROWNING IN DATA** *Magnetic Recording: Winner of the Data Storage Technology Race,* Thomas R. Albrecht *Evolution of Large Multiprocessor Servers,* Kourosh Gharachorloo *Network Survivability and Information Warfare,* Michael K. Reiter *Moving up the Information Food Chain: The Future of Web Search,* Oren Etzioni **MAKING SENSE OF THE HUMAN GENOME** *Genes, Chips, and the Human Genome,* Stephen P. A. Fodor **ENGINEERING NOVEL STRUCTURES** *Colloidal-Scale Engineering,* Eric W. Kaler *Design of Biomimetic Polymeric Materials,* Arup K. Chakraborty **ENERGY FOR THE FUTURE AND ITS ENVIRONMENTAL IMPACT** *Deregulating the Electric Grid: Engineering Challenges,* Thomas J. Overbye *The Future of Nuclear Energy,* Per F. Peterson *Renewable Energy Technologies: Today and Tomorrow,* James M. Chavez and Jane H. Davidson	**Reports 1999**

	OPTICS *Issues Associated with the Volume Manufacturing of Vertical-Cavity Surface-Emitting Lasers,* Thomas M. Brennan and H.Q. Hou *Optical Applications of Microelectromechanical Systems,* Ming C. Wu	
2000 Beckman Center of the National Academies in Irvine, California September 14-16	**Frontiers of Engineering: Reports on Leading-Edge Engineering From the 2000 NAE Symposium on Frontiers in Engineering** **SYSTEMS ENGINEERING** *Systems Engineering Challenges of the International Space Station,* Mark D. Jenks *Battlefield Management,* Mark W. Maier *Software Development at Microsoft*, Marvin M. Theimer **VISUAL SIMULATION AND ANALYSIS** *Physically Based Animation,* David Baraff *Data Mining and Visualization,* Ronny Kohavi *Digital Geometry Processing,* Peter Schröder and Wim Sweldens **ENGINEERING CHALLENGES AND OPPORTUNITIES IN THE GENOMIC ERA** *The Human Genome Project: Elucidating Our Genetic Blueprint,* Eric D. Green *Current Genomic Research: The Proteins Have It,* Lynne J. Regan *Bioengineering for the Science and Technology of Biological Systems,* Douglas A. Lauffenburger *Genomics and Ethics,* Pilar N. Ossorio **NANOSCALE SCIENCE AND TECHNOLOGY** *From Clusters to Automobiles: Processing and Applications of Granular Nanomaterials,* Horst W. Hahn *Science and Technology of Nanotube-Based Materials,* Otto Z. Zhou *Nanoscale Materials: Synthesis, Analysis, and Applications,* Rudolf M. Tromp	**Reports 2000**

2001	**Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2001 NAE Symposium on Frontiers of Engineering**	
Beckman Center of the National Academies in Irvine, California March 1–3, 2002	**FLIGHT AT THE LEADING EDGE: EXTREME AERODYNAMICS FROM THE MEGA TO THE MICRO** *Active Flow Control: Enabling Next-Generation Jet Propulsion Aerodynamics,* Jeffrey W. Hamstra and Daniel N. Miller *Miniature Spy Planes: The Next Generation of Flying Robots,* Stephen J. Morris *Toward Micromechanical Flyers,* Ronald S. Fearing **CIVIL SYSTEMS** *Dynamic Planning and Control of Civil Infrastructure Systems,* Feniosky Peña-Mora *Improbable Is Not Impossible: Decision Making Under Uncertainty,* Linda K. Nozick *Interdependencies in Civil Infrastructure Systems,* Miriam Heller **WIRELESS COMMUNICATIONS** *Design Challenges for Future Wireless Systems,* Andrea Goldsmith *Next-Generation Mobile Wireless Internet Technology,* Rajiv Laroia *Service Architectures for Emerging Wireless Networks,* S. Muthukrishnan *Wireless Integrated Network Sensors (WINS): The Web Gets Physical,* Gregory J. Pottie **TECHNOLOGY AND THE HUMAN BODY** *Applying Simulation Technology to the Life Sciences,* Thomas Paterson *Reengineering the Paralyzed Nervous System,* P. Hunter Peckham *Merging Living Cells and Microsystems Engineering,* Mehmet Toner	

2002 Beckman Center of the National Academies in Irvine, California September 19–21	**Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2002 NAE Symposium on Frontiers of Engineering** **CHEMICAL AND MOLECULAR ENGINEERING IN THE 21ST CENTURY** *Fuel Cells That Run on Common Fuels,* John M. Vohs *Dimension-Dependent Properties of Macromolecules in Nanoscopic Structures,* Juan J. de Pablo and Paul F. Nealey *The Role of Computational Fluid Dynamics in Process Industries,* David Lee Davidson **TECHNOLOGY FOR HUMAN BEINGS** *The Human Factor,* Kim J. Vicente *Human Factors Applications in Surface Transportation,* Thomas A. Dingus *Implications of Human Factors Engineering for Novel Software User-Interface Design,* Mary Czerwinski *Frontiers of Human-Computer Interaction: Direct-Brain Interfaces,* Melody M. Moore **CONTENTS THE FUTURE OF NUCLEAR ENERGY** *Advanced Nuclear Reactor Technologies,* John F. Kotek *Licensing and Building New Nuclear Infrastructure,* Peter S. *Hastings Sustainable Energy from Nuclear Fission Power*, Marvin L. Adams *Stretching the Boundaries of Nuclear Technology,* James P. Blanchard **ENGINEERING CHALLENGES FOR QUANTUM INFORMATION TECHNOLOGY** *Quantum Cryptography,* Steven J. van Enk *Ion-Trap Quantum Computation,* Dietrich Leibfried *Scalable Quantum Computing Using Solid-State Devices,* Bruce Kane	**Reports 2002**

| 2003 Beckman Center of the National Academies in Irvine, California September 18–20 | **Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2003 NAE Symposium on Frontiers of Engineering**

ENVIRONMENTAL ENGINEERING

Microbial Mineral Respiration, Dianne K. Newman
Water-Resource Engineering, Economics, and Public Policy, Gregory W. Characklis
Life Cycle Development: Expanding the Life Cycle Framework to Address Issues of Sustainable Development, Gregory A. Norris

FUNDAMENTAL LIMITS OF NANOTECHNOLOGY: HOW FAR DOWN IS THE BOTTOM?

Status, Challenges, and Frontiers of Silicon CMOS Technology, Jack Hergenrother
Molecular Electronics, James R.
Heath Limits of Storage in Magnetic Materials, Thomas J. Silva
Thermodynamics of Nanosystems, Christopher Jarzynski

COUNTERTERRORISM TECHNOLOGIES AND INFRASTRUCTURE PROTECTION

Biological Counterterrorism Technologies Using Biotechnology to Detect and Counteract Chemical Weapons, Alan J. Russell, Joel L. Kaar, and Jason A. Berberich
An Engineering Problem-Solving Approach to Biological Terrorism, Mohamed Athher Mughal
Infrastructure Protection Internet Security, William R. Cheswick

BIOMOLECULAR COMPUTING DNA

Computing by Self-Assembly, Erik Winfree
Natural Computation as a Principle of Biological Design, Willem P. C. Stemmer
Challenges and Opportunities in Programming Living Cells, Ron Weiss | **Reports 2003** |

2004 Beckman Center of the National Academies in Irvine, California September 9–11	**Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2004 NAE Symposium on Frontiers of Engineering** **ENGINEERING FOR EXTREME ENVIRONMENTS** *Introduction,* Mary Kae Lockwood and John W. Weatherly *Cool Robots: Scalable Mobile Robots for Instrument Network Deployment in Polar Climates*, Laura R. Ray, Alexander D. Price, Alexander Streeter, Daniel Denton, and James H. Lever *The Role of Modeling and Simulation in Extreme Engineering Projects,* Jon Berkoe *The Challenges of Landing on Mars,* Tommaso P. Rivellini *Accessing the Lunar Poles for Human Exploration Missions,* B. Kent Joosten **DESIGNER MATERIALS** *Introduction,* Kristi S. Anseth and Diann E. Brei *Thin-Film Active Materials*, Greg P. Carman *The Future of Engineering Materials: Multifunction for Performance-Tailored Structures*, Leslie A. Momoda *Biomimetic Strategies in Vascular Tissue Engineering,* Jennifer L. West **MULTISCALE MODELING** *Introduction,* Grant S. Heffelfinger and Dimitrios Maroudas *Equation-Free Modeling For Complex Systems,* Ioannis G. Kevrekidis *Modeling the Stuff of the Material World: Do We Need All of the Atoms?* Rob Phillips *Balancing Scales in Biological Models,* Adam Paul Arkin *Small-Scale Processes and Large-Scale Simulations of the Climate System,* Bjorn B. Stevens **ENGINEERING AND ENTERTAINMENT** *Introduction,* Chris Kyriakakis *Capturing and Simulating Physically Accurate Illumination in Computer Graphics*, Paul Debevec *Spatial Audio Reproduction: Toward Individualized Binaural Sound,* William G. Gardner *Designing Socially Intelligent Robots,* Cynthia Breazeal	**Reports 2004**

2005	**Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2005 Symposium**	
GE Global Research Center in Niskayuna, New York September 22–24		

Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2005 Symposium

ID AND VERIFICATION TECHNOLOGIES

Introduction, Stephen S. Intille and Visvanathan Ramesh
Ongoing Challenges in Face Recognition, Peter N. Belhumeur
Designing Biometric Evaluations and Challenge Problems for Face- Recognition Systems, P. Jonathon Phillips
Large-Scale Activity-Recognition Systems, Matthai Philipose

ENGINEERING FOR DEVELOPING COMMUNITIES

Introduction, Garrick E. Louis and Amy Smith
Challenges in Implementation of Appropriate Technology Projects: The Case of the DISACARE Wheelchair Center in Zambia, Kurt L. Kornbluth and Philip Osafo-Kwaako
Engineering Inputs to the CDC Safe Water System Program 45, Daniele S. Lantagne
Sustainable Development Through the Principles of Green Engineering, Julie Beth Zimmerman
Science and Engineering Research That Values the Planet, Daniel M. Kammen and Arne Jacobson

ENGINEERING COMPLEX SYSTEMS

Introduction, Luis A Nunes Amaral and Kelvin H. Lee
Complex Networks: Ubiquity, Importance, and Implications, Alessandro Vespignani
The Promise of Synthetic Biology, Jay D. Keasling
Population Dynamics of Human Language: A Complex System, Natalia L. Komarova
Agent-Based Modeling as a Decision-Making Tool, Zoltán Toroczkai

ENERGY RESOURCES FOR THE FUTURE

Introduction, Allan J. Connolly and John M. Vohs
Future Energy, John K. Reinker
Organic Semiconductors for Low-Cost Solar Cells, Michael D. McGehee
R&D at the U.S. Department of Energy on Hydrogen Production and Storage, Sunita Satyapal
Fuel Cells: Current Status and Future Challenges, Stuart B. Adler

2006 Ford Research and Innovation Center in Dearborn, Michigan, was held on September 21–23	**Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2006 Symposium**	
	THE RISE OF INTELLIGENT SOFTWARE SYSTEMS AND MACHINES	
	Introduction, M. Brian Blake and David B. Fogel	
	Commercializing Auditory Neuroscience, Lloyd Watts	
	Creating Intelligent Agents in Games, Risto Miikkulainen	
	Co-Evolution of Social Sciences and Engineering Systems, Robert L. Axtell	
	Using Computational Cognitive Models to Improve Human-Robot Interaction, Alan C. Schultz	
	THE NANO/BIO INTERFACE	
	Introduction, Tejal Desai and Hiroshi Matsui	
	Biological and Biomimetic Polypeptide Materials, Timothy J. Deming	
	Applications of Biomimetics, Morley O. Stone Optical	
	Imaging for In Vivo Assessment of Tissue Pathology, Rebekah A. Drezek, Naomi J. Halas, and Jennifer	
	West Commercialization and Future Developments in Bionanotechnology, Marcel P. Bruchez	
	ENGINEERING PERSONAL MOBILITY FOR THE 21ST CENTURY	
	Introduction, Apoorv Agarwal and William F. Schneider	
	Long-Term Trends in Global Passenger Mobility, Andreas Schäfer	
	Energy and Environmental Impacts of Personal Mobility, Matthew J. Barth	
	New Mobility: The Next Generation of Sustainable Urban Transportation, Susan Zielinski	
	SUPPLY CHAIN MANAGEMENT AND APPLICATIONS WITH ECONOMIC AND PUBLIC IMPACT	
	Introduction, Jennifer K. Ryan and Julie L. Swann	
	Supply Chain Applications of Fast Implosion, Brenda L. Dietrich	
	From Factory to Foxhole: Improving the Army's Supply Chain, Mark Y.D. Wang	
	Managing Disruptions to Supply Chains, Lawrence V. Snyder and Zuo-Jun Max Shen	
	Engineering Methods for Planning Affordable Housing and Sustainable Communities, Michael P. Johnson	

2007 Microsoft Research in Redmond, Washington September 24-26	**Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2007 Symposium**	

Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2007 Symposium

ENGINEERING TRUSTWORTHY COMPUTER SYSTEMS

Introduction, Ana I. Antón and John Dunagan
Privacy in a Networked World, Rebecca N. Wright
Unifying Disparate Tools in Software Security, Greg Morrisett
Usable Security: Oxymoron or Challenge? Diana K. Smetters

CONTROL OF PROTEIN CONFORMATIONS

Introduction, Donald J. Leo
The Evolutionary Design of Proteins, Rama Ranganathan Contents
Lighting Up the Mechanome, Matthew J. Lang

BİOTECHNOLOGY FOR FUELS AND CHEMİCALS

Introduction, Richard T. Elander and Vijay Singh
Corn-Based Materials, Sanjay V. Malhotra, Vineet Kumar, Anthony East, and Michael Jaffe Process
Review of Lignocellulose Biochemical Conversion to Fuel Ethanol, Bruce S. Dien
Sustainable Biorefineries, Carina Maria Alles and Robin Jenkins

MODELING AND SIMULATING HUMAN BEHAVIOR

Introduction, Christian Lebiere and Robert Wray
Computational Cognitive Neuroscience and Its Applications, Laurent Itti
Barriers, Bridges, and Progress in Cognitive Modeling for Military Applications, Kevin A. Gluck
Modeling of Culturally Affected Human Behavior, Michael van Lent, Mark Core, Steve Solomon, Milton Rosenberg, Ryan McAlinden, and Paul Carpenter

SAFE WATER TECHNOLOGİES

Introduction, Carol R. Rego and Paul K. Westerhoff
Ultraviolet Irradiation: An Age-Old Emerging Technology for Water Treatment, Karl G. Linden

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	Membrane Processes to Address the Global Challenge of Desalination, Amy E. Childress *Biological Treatments of Drinking Water,* Jess C. Brown *Distribution Systems: The Next Frontier,* Vanessa L. Speight	
2008 Sandia National Laboratories at the University of New Mexico, September 18-20	**Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2008 Symposium** **DRUG DELİVERY SYSTEMS** *Introduction,* William J. Grieco and Efrosini Kokkoli *Recent Developments in Needle-Free Drug Delivery,* Samir Mitragotri *Targeted Polymeric Nanotherapeutics,* Jeff Hrkach Polymer *Technology for Gene Therapy,* Daniel W. Pack *Traceable Drug Delivery: Lighting the Way with Qdots*, Xiaohu Gao **EMERGİNG NANOELECTRONİC DEVİCES** *Introduction,* Jia Chen and Victor Zhirnov *The Quest for the Next Information-Processing Technology,* Jeffrey J. Welser *Molecular and Polymer Nanodevices,* Nikolai Zhitenev *Roll Printing of Crystalline Nanowires for Integrated Electronic and Sensor Arrays,* Ali Javey, Zhiyong Fan, Johnny C. Ho, and Roie Yerushalmi *The Role of DNA in Nanoarchitectonics,* Mihrimah Ozkan and **Cengiz S. Ozkan** **COGNİTİVE ENGİNEERİNG** *Introduction,* Barrett S. Caldwell *Cognitive Engineering: It's Not What You Think,* Stephanie Guerlain *Driving Attention: Cognitive Engineering in Designing Attractions and Distractions,* John D. Lee Human *Reliability Analysis in Cognitive Engineering and System Design,* Ronald Laurids Boring *Cognitive Engineering Applications in Health Care*, Ann M. Bisantz *Understanding and Countering the Proliferation of Weapons of Mass Destruction Introduction,* J. Scott Goldstein and Gregory A. Hebner *U.S. National Security in New Times,* Steven D. Nixon	**Reports 2008**

	Combating Weapons of Mass Destruction: Translating Strategic Guidance into Actionable Solutions, Charles L. Beames *Nuclear Deterrence in the 21st Century: The Role of Science and Engineering,* Joseph C. Martz and Jonathan S. Ventura	
2009 The National Academies' Arnold O. and Mabel Beckman Center on September, 10-12	**Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2009 Symposium** **ENGINEERING TOOLS FOR SCIENTIFIC DISCOVERY** *Introduction,* Louise Hamlin, J. Christopher Love, and Naren Ramakrishnan *Digital Holographic Microscopy for 3D Imaging of Complex Fluids and Biological Systems,* Vinothan N. Manoharan *Engineering Tools for Studying Marine Mammals,* Sean M. Wiggins *The Kepler Mission: A Search for Terrestrial Planets*, Riley Duren *Computational Sustainability: Computational Methods for a Sustainable Environment, Economy, and Society,* Carla P. Gomes **NANO/MİCRO PHOTONİCS AND NEW APPLİCATİONS** *Introduction,* Nelson Tansu and Michal Lipson *Optical Antennas: A New Technology That Can Enhance Light-Matter Interactions,* Lukas Novotny *Nano-Opto-Mechanics: Using Light Forces in Guided-Wave Nanostructures,* Matt Eichenfield, Ryan M. Camacho, Jasper Chan, Qiang Lin, Jessie Rosenberg, Amir H. Safavi-Naeini, and Oskar Painter *Light-Emitting Diode Technology for Solid-State Lighting,* Mike Krames **ENGINEERING THE HEALTH CARE DELIVERY SYSTEM** *Introduction,* Stephanie Guerlain and Eva K. Lee Why Health *Information Technology Doesn't Work,* Elmer V. Bernstam and Todd R. Johnson *Calibration in Computer Models for Medical Diagnosis and Prognostication*, Lucila Ohno-Machado, Frederic Resnic, and Michael Matheny *Medical Informatics for Detecting Adverse Events,* Genevieve B. Melton *Managing and Coordinating Health Care: Creating Collaborative, Proactive Systems,* David A. Dorr	[Reports 2009](#)

	RESILIENT AND SUSTAINABLE INFRASTRUCTURE *Introduction,* Seth Guikema and Patrick O'Mara *America's Infrastructure Report Card: Causes, Costs, and Solutions,* Kristina L. Swallow *Infrastructure Resilience to Disasters,* Stephanie E. Chang *The Environmental Footprint of Infrastructure,* Arpad Horvath	
2010 IBM Learning Center in Armonk, New York September 23–25	**Frontiers of Engineering Reports on Leading-Edge Engineering from the 2010 Symposium** **CLOUD COMPUTING** *Introduction,* Ali R. Butt and Dilma Da Silva *Opportunities and Challenges of Cloud Computing,* Armando Fox *Warehouse-Scale Computing: The Machinery That Runs the Cloud,* Luiz André Barroso *Developing Robust Cloud Applications,* Yuanyuan (YY) Zhou *Green Clouds: The Next Frontier,* Parthasarathy Ranganathan **ENGINEERING AND MUSIC** *Introduction,* Daniel Ellis and Youngmoo Kim *Very Large Scale Music Understanding,* Brian Whitman *Doing It Wrong,* Douglas Repetto *Digital Instrument Building and the Laptop Orchestra,* Daniel Trueman *Demystifying Music and Its Performance,* Elaine Chew **AUTONOMOUS AEROSPACE SYSTEMS** *Introduction,* Michel Ingham and Jack Langelaan *Intelligent Autonomy in Robotic Systems,* Mark Campbell *Challenges and Opportunities for Autonomous Systems in Space,* Chad R. Frost *Health Awareness in Systems of Multiple Autonomous Aerospace Vehicles,* Stefan Bieniawski *Certifiable Autonomous Flight Management for Unmanned Aircraft Systems*, Ella M. Atkins	[Reports 2010](#)

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DuPont in Wilmington, Delaware
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Modeling Large-Scale Networks, Tony Jebara
Crowds, Crisis, and Convergence: Crowdsourcing in the Context of Disasters, Kate Starbird
Computational Social Science: Exciting Progress and Future Directions, Duncan J. Watts

COGNITIVE MANUFACTURING

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Distributed Anomaly Detection for Timely Fault Remediation in Modern Manufacturing, Dragan Djurdjanovic
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ENERGY: REDUCING OUR DEPENDENCE ON FOSSIL FUELS

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Bioenergy Technologies and Strategies: A New Frontier, Joyce C. Yang
Artificial Solar Fuel Generators, Miguel A. Modestino and Rachel A. Segalman

FLEXIBLE ELECTRONICS

Introduction, Yueh-Lin (Lynn) Loo and Tse Nga (Tina)
Ng Materials and Process Engineering for Printed and Flexible Optoelectronic Devices, Antonio Facchetti
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2014	**Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2014 Symposium**	
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	SHALE GAS AND OIL Session co-chairs: Billy Bardin, Dow Chemical Company, and Christopher Jones, Georgia Tech *Introduction*, Session co-chairs *Shale Natural Resources,* Stephen Ingram, Halliburton *Microbial Ecology of Hydraulic Fracturing: Implications for Sustainable Resource Development*, Kelvin Gregory, Carnegie Mellon University *The Shale Gas Revolution: A Methane to Organic Chemicals Renaissance?*, Eric Stangland, The Dow Chemical Company	
2015	**Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2015 Symposium** Chair: Robert Braun, Georgia Institute of Technology **CYBERSECURITY AND PRIVACY** Session co-chairs: David Brumley, Carnegie Mellon University, and Daniela Oliveira, University of Florida *Introduction* *Security at Different Layers of Abstractions: Application, Operating Systems, and Hardware* Bryan Payne, Netflix *Computer Security and Privacy Where Human Factors Meet Engineering* Franziska Roesner, University of Washington *Interdisciplinary Security: Medical Devices* Kevin Fu, University of Michigan *Challenges of Engineering Cybersecurity: A Government Perspective* Tomas Vagoun, National Coordination Office for Networking and Information Technology R&D **ENGINEERING THE SEARCH FOR EARTH-LIKE EXOPLANETS** Session co-chairs: Sara Seager, Massachusetts Institute of Technology, and Mitchell Walker, Georgia Institute of Technology *The James Webb Space Telescope* Amy Lo, Northrop Grumman Aerospace Systems	[Reports 2015](#)

Starlight Suppression:Technologies for Direct Imaging of Exoplanets
Dmitry Savransky, Cornell University
Realizing Large Structures in Space
Jeremy Banik, Air Force Research Laboratory
Sensing Controls for Space-Based Planet Finding
Jonathan Black, Virginia Tech

OPTICAL AND MECHANICAL METAMATERIALS
Session co-chairs: Jennifer Dionne, Stanford University, and Luke Sweatlock Northrop Grumman Aerospace
Systems
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Materials by Design: 3-Dimensional Architected Nanostructured Meta-Materials
Julia Greer, California Institute of Technology"
Mechanical Metamaterials: Design, Fabrication, and Performance
Christopher Spadaccini, Lawrence Livermore National Laboratory
Metamaterial-Based Device Engineering
Andrea Alu, University of Texas at Austin
Catching Light Rays: Refractory Plasmonic Materials for Energy Conversion, Data Storage, and Medical Applications
Alexandra Boltasseva, Purdue University

FORECASTING NATURAL DISASTERS
Session co-chairs: Amir AghaKouchak, University of California, Irvine, and James Done, National Center for
Atmospheric Research
Introduction
Assessing and Managing Hurricane Risk in a Changing Climate
Ning Lin, Princeton University
The Economics of Natural Disasters: Moving from Risk Assessment to Risk Reduction
Jeffrey Czajkowski, University of Pennsylvania
Google Earth Engine: A New Platform for Global-Scale Disaster Risk Resilience

	Rebecca Moore, Google	

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