

EXEMPLAR



COLLEGE of ENGINEERING

FALL 2013

CELEBRATING



YEARS OF EXCELLENCE

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Michelle Moser

Sydney Redigan

Chris Williams

DESIGN

Joseph Bowles

PHOTOGRAPHY

Rick Bielaczyc

Mary Jane Murawka

Exemplar is published for alumni and friends of the College of Engineering.

**WAYNE STATE UNIVERSITY
COLLEGE OF ENGINEERING
5050 ANTHONY WAYNE DRIVE
DETROIT, MI 48202
ENGINEERING.WAYNE.EDU**



COLLEGE of ENGINEERING

EXEMPLAR

GREETINGS FROM THE DEAN

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Dear alumni and friends,

For 80 years, the College of Engineering at Wayne State University has shined. Its faculty members have pioneered, educated and inspired. Its alumni have innovated, succeeded and gone on to lead. Its students have questioned, grown and challenged us all to be better. For 80 years, the college has been embraced as a partner and trailblazer by industry.

I am grateful to lead this extraordinary community as it celebrates 80 years of excellence in education and research innovation. This edition of *Exemplar* celebrates the college's remarkable history and highlights its path to another 80 years of distinction. You'll read about some of the college's many accomplishments and gain a better understanding of the effect the college has had on industry, in the community and in academia. For instance, did you know College of Engineering alumni invented frontal-impact crash dummies and three-dimensional holograms? Or that its professors created the first mechanical heart pump and invented the intermittent windshield wiper?

From its chemical engineering-based beginnings in 1933, the college has gone on to pioneer new fields and adapt programming to address the changing needs of consumers, industry and students. That tradition continues today with a more interdisciplinary approach to educating students and innovating new technologies in health care, automobile safety, energy solutions, manufacturing and materials, big data and business analytics, engine optimization, and transportation. Additionally, the college has increased its focus on providing students with more experience in these areas, thanks to added opportunities for hands-on learning, internships and co-ops, scholarships, undergraduate research, and avenues to gain a global perspective.

As we celebrate the college, I would like to congratulate Nathan Fisher, Timothy Gates, Chandan Reddy and Alper Murat, who were tenured and promoted to the rank of associate professor. Congratulations also are in order for Gene Liao, Weisong Shi and Yong Xu, who were promoted to the rank of full professor. The college also welcomed six new faculty members in five departments to strengthen our aforementioned areas of excellence: Alexander Kotov, Guru Dinda, Leela Arava, Mai T. Lam, Jeremy Rickli and Haipeng Liu.

Enrollment is up once again at the college. We are collaborating with more local and international companies, organizations, and institutions in unique ways. Discoveries are being made each day. College of Engineering alumni, students, faculty members and friends continue to build upon the college's remarkable history and will no doubt solidify their place in the college's timeline 80 years from now.

Thank you for your continued support and friendship. Please enjoy this issue of *Exemplar*.

Dean Farshad Fotouhi

80 YEARS OF EXCELLENCE

SELECT WAYNE STATE UNIVERSITY COLLEGE OF ENGINEERING ACCOMPLISHMENTS



1920s

1930s



'20 Professor **Ernest Drake** develops the first engineering courses for what was then called the Detroit Junior College, offered as part of the chemistry program.

'33

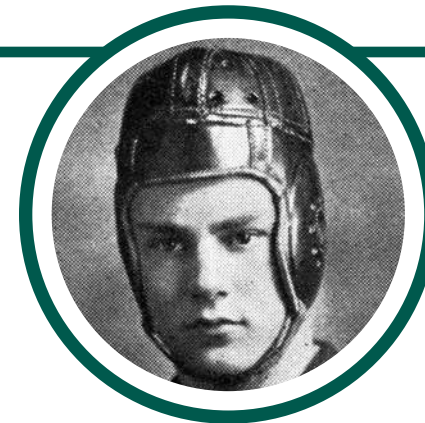
Chemistry professors **Arthur R. Carr** and **Ernest Drake** develop a chemical engineering program that grows into the College of Engineering. Carr is named the first dean of the College of Engineering.



'34

The group of colleges united by the Detroit Board of Education is renamed Wayne University. **Howard Hess** receives the first bachelor's in electrical engineering at Wayne University. He later becomes a Wayne professor, associate dean and acting dean. The first issue of student engineering magazine *The Buzz Saw* is published, a precursor to the *Wayne Engineer* student publication.

HALL OF FAME



'35

Jack Morton graduates with a bachelor's in electrical engineering. He is involved in Bell Labs' critical decision to switch to silicon-based technology, a choice that eventually leads to the creation of the microchip.



'39

Walter O. Stanton graduates with a bachelor's in electrical engineering. He goes on to invent an easily replaceable phonograph stylus that was crucial to creating the consumer market for audio equipment. The Bioengineering Center is founded by **Herbert R. Lissner**, professor and chair of mechanical engineering, and **E.S. Gurdjian**, chair of the Department of Neurotrauma at the School of Medicine. It paves the way in biomechanics with studies of skull fractures and the use of human cadavers in automobile safety tests.



'28

Elinor Batie receives a degree in chemical engineering, becoming the first female engineering graduate in the school's history.

'44

The college receives professional accreditation by the Engineers' Council for Professional Development, now called the Accreditation Board for Engineering and Technology. Industrial engineering courses appear in the University Bulletin for the first time.

1940s



'49

Construction begins on a new building located on Anthony Wayne Drive and Warren Avenue. Prior to building completion, engineering classes took place in Old Main and local residences.



'47

Assistant Professor of Chemical Engineering and alumnus **Ernest Kirkendall's** research brings him international acclaim as the discoverer of the migration of diffusion boundaries in solid metals, a phenomenon now known as the Kirkendall Effect.

HALL OF FAME



During the 1940s, the college grows to eight departments: aeronautical, civil, chemical and metallurgical, electrical, engineering mechanics, mechanical and industrial, drawing, and shop.



'50

Classes are held in the college's new building.



'57

J. Stuart Johnson becomes the second dean of the College of Engineering.

Robert Kearns, inventor of the intermittent windshield wiper and subject of the film *Flash of Genius*, serves as professor of mechanical engineering from 1957 to 1967.

'51

The Michigan Epsilon chapter of Tau Beta Pi is chartered at Wayne University.



'52

Wayne engineers invent a mechanical heart pump used in the world's first successful open heart surgery. It was first used in 1952 at Harper Hospital in Detroit and had been developed in the early 1950s by **Dr. Forest Dodrill** and a group of GM research scientists and engineers.

'56

Wayne University becomes Wayne State University. The Board of Governors is formed with 11 members.



'59

Mechanical Engineering Professor **Edward Zobel** is awarded the first Arthur Raymond Carr Award for Excellence in Teaching.

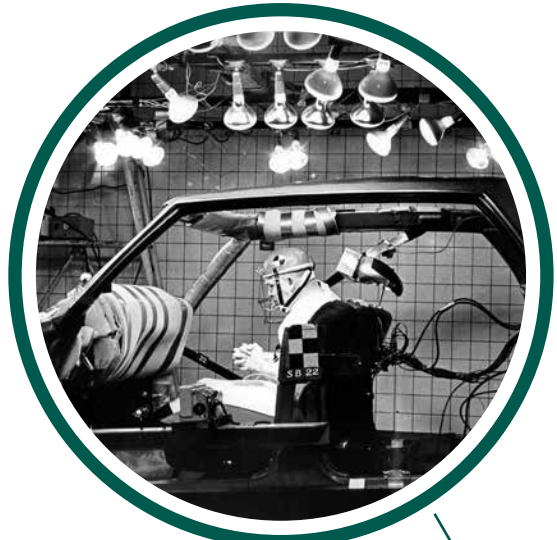
HALL OF FAME

'58

Tau Beta Pi pledges construct two large bents, one in cement that is embedded in the lawn of the Engineering Building (and subsequently removed in a construction project) and one that is a freestanding model displayed in the first-floor hallway of the Engineering Building.

Robert Byrum, a longtime advocate and friend of the college, graduates with a bachelor's in mechanical engineering. He launches Sensor Manufacturing Company in 1977, specializing in the development and manufacturing of transducer elements, sensor components and other test devices.





'60

The college holds its inaugural Honors Convocation. Professors **Herbert Lissner** and **Larry Patrick** develop the WSU Tolerance Curve, which predicts the risk of head injury in automobile accidents. Today, this work remains the foundation for motor vehicle and sports equipment safety standards throughout the world.



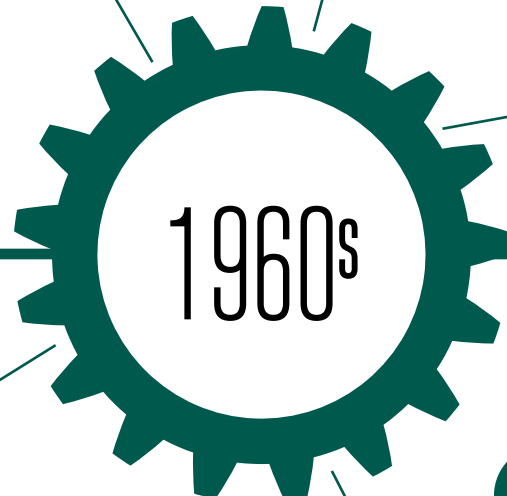
'61

Neal Loving graduates with a degree in aeronautical engineering at the age of 45, becoming the oldest full-time engineering graduate at the time.

HALL OF FAME

'62

The college bestows its first doctorate degree in chemical and metallurgical engineering to **Otto Schweitzer**.



HALL OF FAME

'65

Triple alumnus **Larry Patrick** leads the Bioengineering Center beginning in 1965. He volunteers for experiments, even riding the crash sled for the sake of scientific advancement. His work leads to advancements in the development of the air bag, seat belt, safety glass, collapsible steering column, dashboard and other safety features available in today's vehicles.

'68

Ali Bulent Cambel becomes the third dean of the College of Engineering. **Theresa Krolkowski** becomes the first woman to earn a doctorate in engineering from Wayne State.



HALL OF FAME



'70

Stanley K. Stynes, Hall of Fame inductee, becomes the fourth dean of the College of Engineering. The college's Clean Air Car Race team wins the 10-day, coast-to-coast national competition. Hall of Fame inductee, alumnus and long-time college advocate **Brian Geraghty** is a member of the team, which introduces an emission control system design used in most cars produced in the U.S.



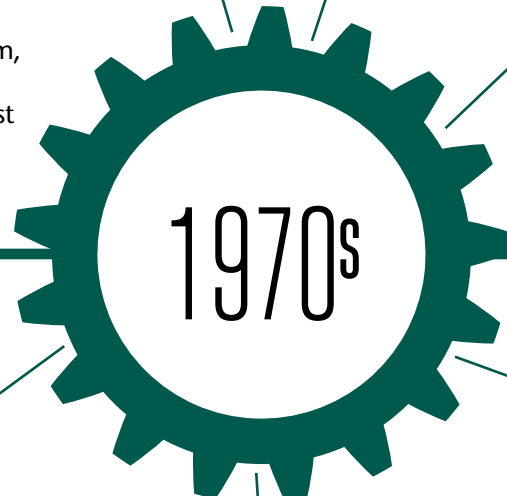
'72

GM engineer and triple alumnus **Harold "Bud" Mertz** introduces a frontal-impact crash dummy that quickly becomes the gold standard for automotive crash-related testing.



'73

Students enroll in the new Engineering Technology program.



HALL OF FAME

'74

Yousif Ghafari receives a bachelor's in mathematics in 1974, a master's in applied mathematics and computer applications in 1975, and a master's in chemical engineering in 1981 from Wayne State. With an entrepreneurial vision for the use of computers in manufacturing design, he establishes Ghafari Associates LLC in Dearborn in 1982.



HALL OF FAME

'77

Jim Anderson, who had earned his bachelor's and master's degrees in civil engineering, founds Urban Science, a business-solutions company focused on supporting the sales and marketing functions of the global automotive industry.

'78

Emmett Leith, who with a coworker presented the world's first 3-D hologram at a conference in 1964, receives a doctorate in electrical engineering.



HALL OF FAME

HALL OF FAME

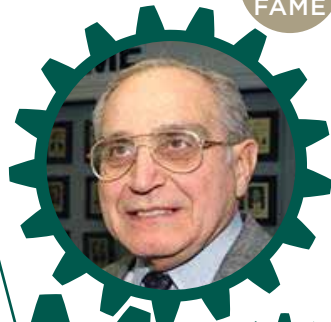


'83

The college celebrates its 50th anniversary by establishing the Hall of Fame and inducting 35 distinguished alumni as charter members.

Joseph Louvar, a 2013 Hall of Fame inductee, internationally recognized expert on chemical process safety and former director of chemical engineering at BASF, graduates with a doctorate in chemical engineering. He later co-authors a leading chemical engineering textbook, *Chemical Process Safety: Fundamentals With Applications*.

HALL OF FAME



Harry Kalajian, who had earned his bachelor's and master's degrees in mechanical and industrial engineering, respectively, and other committed alumni form an alumni association to support the college in the 1980s. The Engineering Alumni Association is active today under the leadership of 2013-14 President **Tony Duminski**, who earned his bachelor's and master's degrees in electrical engineering.

The Center for Automotive Research is established, thanks to the efforts of Mechanical Engineering Professor **Naeim Henein**.



1980s

'89

Bruce White's sculpture, *The Helios Trail*, is installed.

Wayne State's Michigan Epsilon Chapter of Tau Beta Pi constructs the Bent monument to represent its organization.



'86

Fred Beaufait is appointed the fifth dean of the College of Engineering.

Construction is completed on the three-story administration and office wing of the Engineering Building. Prior to this, faculty and administrative offices were located in apartments on Putnam Street.



HALL OF FAME



'84

Groundbreaking for new three-story administration and office wing of the Engineering Building.

Randy Rogers, a 2013 Hall of Fame inductee and senior vice president and chief operating officer of CDM Smith, graduates with his second College of Engineering degree — a master's — in civil engineering.

COLLEGE of ENGINEERING

HALL OF FAME

ESTABLISHED IN 1983

Class of 2013

Robert Brown, EMMP '95
Joseph Louvar, PhDChE '83
Randy Rogers, BSCE '80, MSCE '84
Donald Smolenski, MSChE '79,
PhDChE '90
Shyam Veeramachineni, MSCE '95

Class of 2012

Matthew J. Craig, MSME '99,
PhDBME '07
Sandeep Johri, MSIE '86
Adriana Karaboutis, BSCS '86,
MSECE '86
Akram R. Zahdeh, PhDME '90

Class of 2010

Laxmi Bhuyan, PhDEE '82
Dr. Tobenette Holtz, BSAeroE '59
Paul Sgriccia, MSCE '97
Doug S. Szopo, MSIE '78

Class of 2009

Dr. Tapan K. Datta, MSCE '68
Suhada Jayasuriya, MSME '80,
PhDME '82
George Y. Karmo, MSCEE '77
Paul U. Strauss, BSEE '49
Dr. Sang-Kee Suh, MSMetE '72
Raymond J. Tessier, MSCEE '75,

Class of 2008

Thomas A. Amato, BSChE '86
Andrew J. Haliw III, BSEE '68
Bilal M. Kaafarani, BSChE '81
William H. Osbourn, MSME '86
Avinash W. Rachmale, MSCE '90,
HWM '92
Dr. Rob A. Rutenbar, BSEE '78
Anthony Tai, MSEE '74, PhDEE '78

Class of 2006

J. Gerald Demirjian, BSME '54, MSIE '56
Russell J. Ebeid, MSIE '68
Frank O. Klegon, BSEE '77
Curt G. Korneffel, BSCE '71
Hank M. Kuchta, BSChE '80
Nancy L. Philippart, BSIE '80

Class of 2005

Dr. Grace M. Bochenek, BSEE '86
Paul S. Gill, MSIE '67
Lushman S. Grewal, MSEE '67
Athanasios N. Nasr, PhDEE '86
Priyaranjan Prasad, MSME '68,
PhDME '73
Robert L. Ryan, BEE '66

Class of 2004

Joseph A. Boelter, BChE '65, MSChE '66
James A. Croce, BSEE '86
Robert A. Fenech, BSME '69
Brian J. Geraghty, MSME '72
Orest Iwasiuk, MSME '85
Susan E. Iwasiuk, MSME '87
Barbara J. Samardzich, MSIE '95
Robert J. Thomas, MSEE '69, PhDEE '73

* In memory

Class of 2003

Michael Bolon, BSME '68, MSME '72
George J. Dellas, BSIE '67, MSIE '74
William S. Marras, MSIE '78, PhDIE '82

Class of 2002

Nabil S. Hakim, MSME '70, PhDME '76
Michael F. Marino, BSET '78, MBA '80
Jay Shah, MSCE '70
David A. Skiven, MSCE '74 *

Class of 2001

Fredrick Bauer, BSEE '41, MSEE '49 *
Steven E. Kurmas, BSChE '79, MSChE '83
Fred C. Levantrosser, BSCE '60, MSCE '67
Neal Loving, BSAeroE '61 *

Class of 2000

Lawrence J. Achram, BSME '82, MSME '84
Dr. Robert C. Banasik, BSME '65

Class of 1999

Andrew Brown, Jr., BSChE '71, MBA '75,
PhDIE '92

Class of 1998

Charles T. Robinson, BSCE '70, MSCE '71

Class of 1997

Joseph R. Corace, BSMET '77
Randall T. Murphy, MSIE '68

Class of 1996

James M. Elkouri, BISE '69
Dr. James R. Schaaf, BSCE '65

Class of 1995

James A. Anderson, BSCE '67, MSCE '70
Frank Perna, Jr., MSEE '66
Raj Vattikuti, MSEE '76

Class of 1994

Ronald P. Knockeart, MSEE '67
Joseph B. Olivieri, PhDME '88 *
Dr. Dennis F. Wilkie, BSEE '64, MSEE '66
Ronald Boltz, MSME '71

Class of 1993

Richard A. Gerardo, BSChE '66
Maurice S. Greenberg, BSCE '42 *
Bruno Leonelli, BSChE '93 *

Class of 1992

Roman E. Boruta, BSME '51 *
Robert L. Byrum, BSME '58 *
Lydia B. Lazurenko, BSME '55, MSME '72
Tito R. Marzotto, BSCE '62, MSCE '67
Dr. Richard A. Schapery, MSME '57

Class of 1991

Gerald DeClaire, BSME '49
David G. Kolodziej, BSME '59, MSME '62
Kenneth W. Schang, BSME '65, MSME '69
Adrian Toader, BSEE '79

Class of 1990

Yousif B. Ghafari, MSChE '81,
Hon. PhD '08
Albert I. King, MSME '61, PhDME '66
James R. Moden, BSChE '53, MSChE '67

Class of 1989

Dr. Norman N. Li, MSChE '57
Ali M. Nasle, MSEE '66

Class of 1988

John Banicki, BSCE '51
Harry Kalajian, BSME '54, MSIE '55
Perry L. McCarty, BSCE '53
Dr. Stanley K. Stynes, BSChE '55,
MSChE '58

Class of 1987

Douglas V. Doane, BSChE '42 *
Leroy H. Runk, MSIE '65

Class of 1986

David J. Buchner, MSChE '55
Joseph Hyman, BSME '52 *
Joseph T. Inatome, BSME '50 *
Emmett M. Leith, PhDEE '78 *
James G. Morris, BSCE '50
Charles Wales, BSChE '53 *

Class of 1985

Fredrick P. Bens, BSChE '36 *
Fredrick E. Lueck, BSME '56
Thomas V. Reinauer, BSME '49 *
Dr. Clarence Raymond Wylie Jr.,
BSChE '31 *

Class of 1984

Dr. Harold G. Donnelly, BSChE '36 *
Philip Eisenberg, BSCE '41 *
Dr. William O. Harms, BSMetE '49 *
David H. Hill, MSIE '62
Walter J. Kapryan, BSAeroE '47
Howard H. Kehrl
Dr. Ernest K. Kirkendall, BSChE '34 *
Frank Metyko, MSCE '41 *
Karl E. Schmidt, BSME '35, MSME '36,
Hon. PhD '58 *
Marion M. Semchysheh, BSChE '42,
PhDMetE '63 *

Class of 1983

William T. Birge, BME '52
Dr. Donald J. Blickwede, BSChE '42 *
Daniel J. Bohn, Jr., BSCE '54, MSCE '55
Franklin A. Burn, BSCE '50
Maurice N. Day, BSIE '49
Woodrow B. Dolphin, BSEE '37 *
John G. Frank, MSChE '55
Howard M. Hess, BSEE '34 *
Roy E. Hock, BSEE '51
Robert Lien Jones, BSIE '49, MSIE '59 *
Sol Love, BSAeroE '41
Ernest R. McCamman, BSCE '51 *
John R. Nyland, BSIE '58 *
Lawrence M. Patrick, BSME '42,
BSAeroE '44, MSME '55 *
Louis R. Ross, BSME '54 *
John W. Shier, BSChE '48 *
Fredrick A. Stewart, MSCE '74
George A. Timmons, BSChE '34 *
William H. Weltyk, BSME '56
Robert G. Wingerter, BSME '38 *
William G. Wood, BSChE '41

Note: There were no Hall of Fame inductions in 2007 or 2011.

'90

Donald Smolenski, a 2013 Hall of Fame inductee, graduates with his second College of Engineering degree — a doctorate — in chemical engineering. After many years at GM, he is named OEM liaison manager at Evonik Oil Additives USA in 2012.



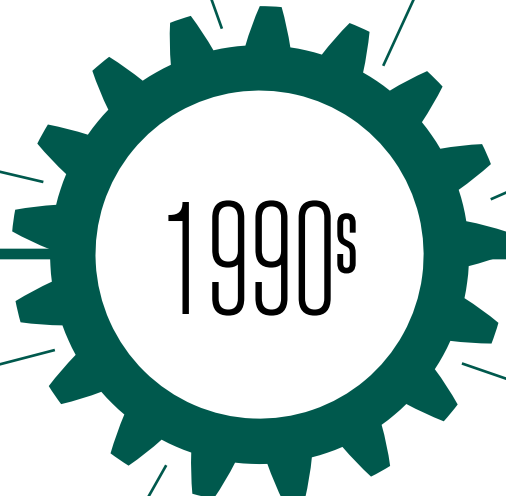
HALL OF FAME

'91

Chemical Engineering Professor **Erhard Rothe** receives the Joint Research Prize from the Max Planck Society and the Alexander von Humboldt Foundation.



HALL OF FAME



'93

Chemical Engineering and Materials Science Professor **Esin Gulari** becomes the first woman to be appointed a department chair at the college.

HALL OF FAME



'95

A group of Wayne State engineering students wins first place overall in the Department of Energy/Chrysler Hybrid-Electric Vehicle Challenge.

The college, in partnership with Ford Motor Co., launches the Engineering Management Master's Program (EMMP).

Shyam Veeramachineni, a 2013 Hall of Fame inductee and executive vice president at Professional Service Industries Inc., graduates with a master's in civil engineering.

Robert Brown, a 2013 Hall of Fame inductee and vice president of Sustainability, Environment and Safety Engineering at Ford Motor Co., earns a master's through the college's EMMP.

Chemical Engineering faculty members **Charles Manke** and **Esin Gulari** receive the Henry Ford Technology Award from Ford Motor Co. for their collaborative research with Ford on polymer additives for reduction of machining fluid mist formation.

HALL OF FAME



'96

Chin Y. Kuo becomes the sixth dean of the College of Engineering.



'97

The new Manufacturing Engineering Building opens.

'98

Team Ethanol wins the national Ethanol Vehicle Challenge. A brain injury computer model developed by Bioengineering Center faculty and students, including mechanical engineering professors **Albert King** and **King-Hay Yang**, is recognized with the Smithsonian Institution's ComputerWorld-Smithsonian Medal.



'01

The Olbrot Commemorative Sculpture, which honors Electrical and Computer Engineering Professor **Andrzej Olbrot**, is unveiled.



HALL OF FAME

'00

Professor **Albert King** is inducted into the National Academy of Engineering.

'02

Wayne State Board of Governors approves the formation of the Department of Biomedical Engineering, bridging the College of Engineering and the School of Medicine. **Mark Haacke**, professor of biomedical engineering and radiology, patents a new MRI technique, susceptibility weighted imaging (SWI), which provides better diagnosis of neurological trauma and disease.



'03

Wayne State begins its involvement in Formula SAE. Computer Science Professor **Sorin Draghici** publishes *Data Analysis Tools for DNA Microarrays*, a widely adopted book that lowers the communication barrier between life scientists and analytical scientists, helping them analyze microarray data to make informed choices about the techniques to use in a given situation.

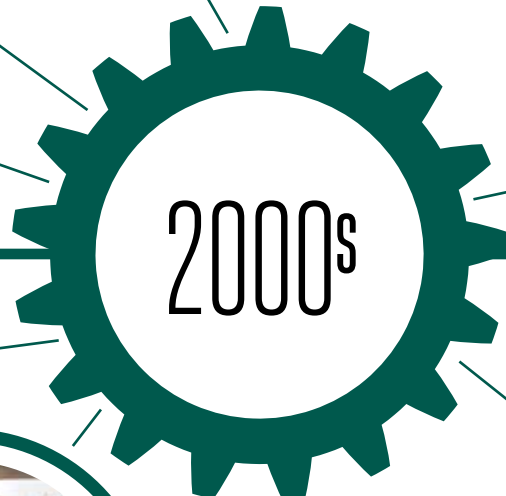


'04

HALL OF FAME



Ralph Kummler is appointed the seventh dean of the College of Engineering. The college adds a master's program in Alternative Energy Technology with a \$300,000 grant from NextEnergy. **Avinash Rachmale**, who earned a master's degree in civil engineering, begins testing groundwater for industrial and municipal projects in Detroit, launching what is now a multinational engineering firm. He currently serves as chairman of Lakeshore Toltest Corp.



'06

WSU partners with NextEnergy to open the National Biofuel Energy Lab, made possible by a \$2.5 million U.S. Department of Energy grant.



'09

The Marvin I. Danto Engineering Development Center opens. The college establishes the Electric-drive Vehicle Engineering program, the nation's first, with a \$5 million federal grant from the U.S. Department of Energy. Associate Professor **Caisheng Wang** installs a wind turbine on the roof of the Engineering Technology Building, creating a renewable energy system strong enough to power a computer lab.



HALL OF FAME

'08

Steve Kurmas, who earned his bachelor's and master's degrees in chemical engineering, is elected president and COO of DTE Electric Co. after serving in a number of leadership roles in power generation, fuel supply and electric distribution at MichCon and DTE Energy.

'07

The college breaks ground on the Marvin I. Danto Engineering Development Center. Partners for the Advancement of Collaborative Engineering Education (PACE) identifies the college as one of 53 academic institutions worldwide to develop the automotive product lifecycle management team of the future with General Motors, Autodesk, HP, Oracle and Siemens PLM Software.

'10

The college welcomes the first class of undergraduate biomedical engineering students.

The college launches its EDGE Engineering Entrepreneur Certificate Program.

College community members fill the Danto Center's courtyard for the dedication of Kummler Commons in honor of Ralph Kummler, former dean.



'11

Farshad Fotouhi is appointed the eighth dean of the College of Engineering.

The Department of Computer Science is transferred from the College of Liberal Arts and Sciences to the College of Engineering to align these two disciplines.

WSU students are chosen to participate in EcoCAR 2: Plugging In to the Future, an engineering competition in which 15 North American university teams compete over three years to convert a gasoline-powered production car into a fully functional hybrid vehicle.



'12

The Marvin I. Danto Engineering Development Center receives LEED Silver certification as designated by the U.S. Green Building Council.

Following an 18-month collaborative process among students, faculty and alumni volunteers, the college faculty endorses a 2012-17 strategic plan to improve the quality of life through education, innovation and entrepreneurship.

Kenneth Chelst, professor of operations research, publishes *Value-Added Decision Making for Managers*.

'13

The College of Engineering and WSU's Office for International Programs announce the creation of the Global Experience Scholarship Program, which provides engineering and computer science undergraduate students an opportunity to gain research and industry experience abroad.

Dean Fotouhi introduces Five Pillars to a Wayne State engineering and computer science education: experiential learning through co-ops and internships, hands-on experience, global perspective, scholarships, and undergraduate research.

The Board of Visitors launches the Helios Fund to benefit the Five Pillars.

The College of Engineering celebrates 80 years of history on Oct. 26 at the Westin Book Cadillac Detroit during the 2013 Night of the Stars.

2013 and BEYOND:

A PROMISING FUTURE



HEALTH CARE:

Enhancing quality of life

Assistant Professor Harini Sundararaghavan (left) and biomedical engineering Ph.D. student Tonya J. Whitehead

Thirty College of Engineering professors — more than a quarter of the entire faculty — are helping save lives through health care related research. They represent departments you'd expect, like biomedical engineering, chemical engineering and materials science, and those you might not, like industrial and systems engineering, computer science, and electrical and computer engineering.

At Wayne State University, the partnership between the School of Medicine and the College of Engineering goes back nearly 80 years, producing significant advancements, especially in biomechanics. These days, WSU researchers are making great strides in nanomaterials and tissue engineering for regeneration and rehabilitation therapy.

Consider the complex recovery process for someone with a spinal cord injury. Traditional thinking was that neurons could not regrow, resulting in permanent paralysis. However, Assistant Professor of Biomedical Engineering Harini Sundararaghavan and researchers in her laboratory are exploring new data that suggest it is the environment around the neurons that prohibits them from growing, not the neurons themselves. Her team is working to mimic the natural properties of neural tissue on existing scars, creating a more favorable material on which neurons can grow. The aim is to reconnect healthy tissue around an injury.

Sundararaghavan's work could have implications for individuals with peripheral and spinal cord injuries, including injured veterans returning from combat in Afghanistan and Iraq. "The ultimate goal is to help people who are severely injured," Sundararaghavan says, "because right now there is no treatment for people who are quadriplegic or paraplegic."

Additionally, renowned professors such as Howard Matthew, Guangzhao Mao and Sandro da Rocha continue groundbreaking

work in biomaterials and are discovering more effective ways to deliver drugs. New faculty member Mai Lam's research focuses on the use of tissue mechanics to design treatment approaches for repairing a given tissue using biomaterials and stem cells.

Molecular and cellular imaging work at Wayne State, led by Biomedical Engineering Chair Dr. Juri Gelovani and Dr. Weiping Ren, will lead to earlier diagnosis of various cancers, help in the selection of individualized cancer therapies, and maximize the benefits of regenerative stem cell therapies.

Working to address health care needs inspires many Wayne State professors to invent devices. Yong Xu's wearable accelerometers for continuous respiratory sound will improve patient outcomes by providing continuous telemonitoring to health care professionals. Abhilash Pandya's intelligent autonomous camera control for robotics will reduce the time, complexity and staffing needed in minimally invasive robotic surgeries. Assistant Professor Amar Basu's ultra-small wearable heart rate monitor allows for continuous monitoring to detect various chronic diseases.

Bioinformatics research by faculty members Sorin Draghici and Hamidreza Chitsaz could improve cancer diagnosis and treatment and help biologists better understand genetic-level interactions. And industrial and systems engineering faculty experts such as Darin Ellis, Leslie Monplaisir, Kai Yang and Kyoung-Yun Kim are enhancing product design and development of medical devices and equipment, as well as improving processes in the health care setting.

The college recently hired an industrial liaison, Lori Simoes, to further connect the research of its faculty with organizations that can bring their discoveries to practical use.

“Our engineering faculty members are working on impressive projects that have the potential to change the face of health care,” Simoes says. “Here in Midtown, our campus brushes elbows with powerhouse hospital systems, and we’re forging deep partnerships to combine our resources of maximum impact.”



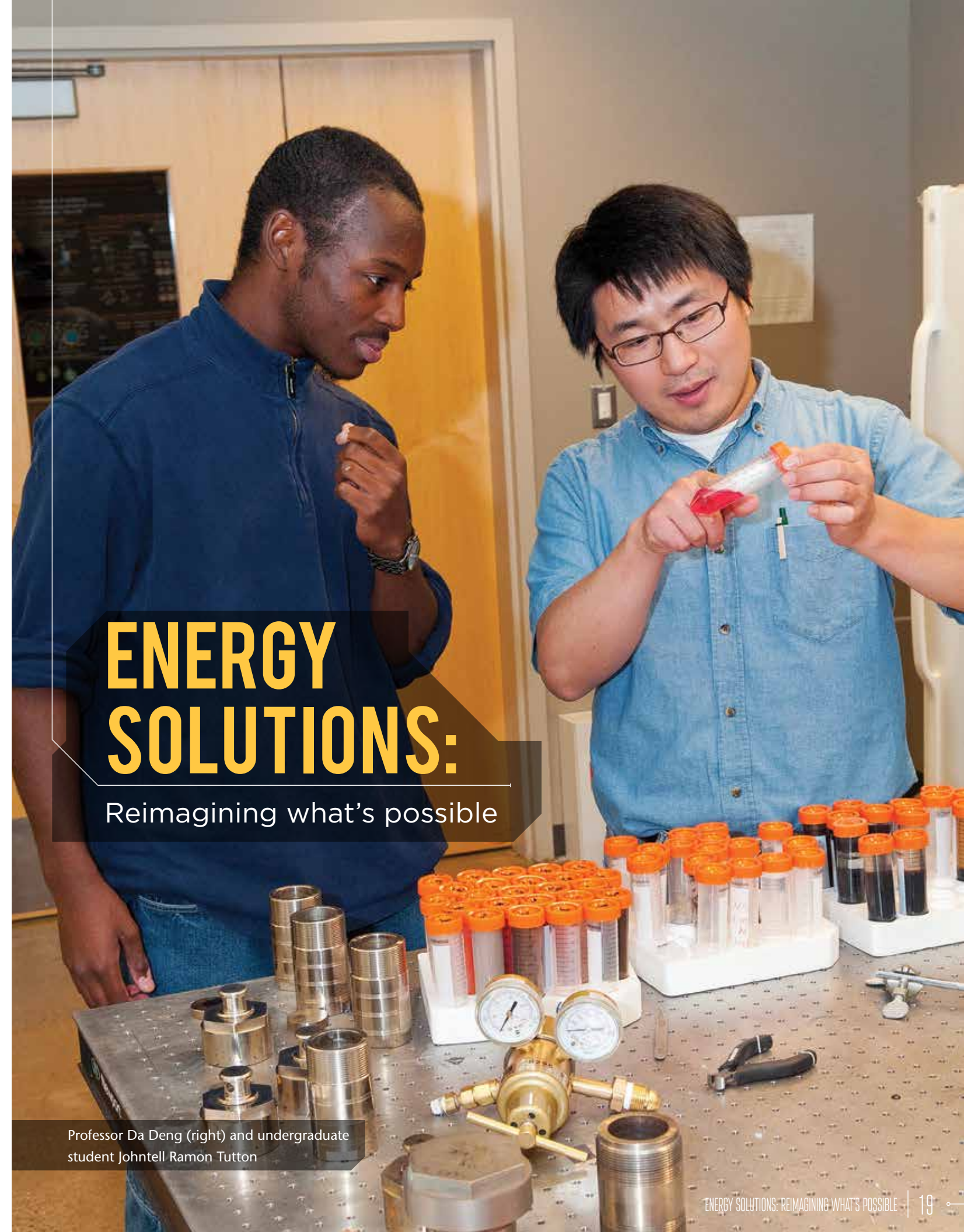
Organizations such as Stryker, Medtronic, GE Healthcare, Henry Ford Health System and the Veterans Health Administration consistently employ Wayne State engineering alumni. They also offer internships, allowing students to participate in research and innovation that will have an immediate effect on the real world.

One particularly meaningful example is Life Beyond Barriers, a partnership among global automotive retail consulting firm Urban Science, the College of Engineering and the DMC’s Rehabilitation Institute of Michigan. The program combines world-class resources in the medical and biotechnological engineering fields to develop solutions that help disabled people around the world overcome the physical challenges they face every day.

The organization funds prototype design and development in the undergraduate biomedical engineering design laboratory. One such prototype is a weightlifting set for wheelchair-bound individuals to make it easier for them to do resistance training.

WSU students on the Life Beyond Barriers development team are empowered with the ability to bring their products to market, producing a new generation of inventive entrepreneurs.

“This not only enriches the education of our undergraduate biomedical engineering students, it aims to improve the quality of life for people facing injuries and disabilities around the globe as well,” says Michele Grimm, biomedical engineering undergraduate program chair. “By providing the funding and an avenue to develop quality solutions to real-world patient challenges — and potentially take them to market — Life Beyond Barriers clears a path for entrepreneurial growth previously not available to our students.”



ENERGY SOLUTIONS:

Reimagining what's possible

Professor Da Deng (right) and undergraduate student John Tell Ramon Tutton

Da Deng's research on green energy storage materials could significantly affect electric and hybrid vehicles, personal mobile electronic devices, and green energy storage solutions.

"I'd like to improve electrochemical performance for next-generation electrochemical energy storage devices by increasing levels of energy, power density, enhancing safety and cyclability, and reducing the overall environmental footprint and cost of storage devices," says the assistant professor of chemical engineering and materials science.

According to College of Engineering Dean Farshad Fotouhi, Deng's goals are very much in line with the overall needs of today's consumers, who want access to more affordable, greener products and resources that offer longer life, less hassle and less environmental risk.

"Today's consumers want batteries that pack a bigger punch, longer-lasting phones, sustained power to homes and businesses, and cleaner, more efficient fuels to make vehicles go farther distances," says Fotouhi. "There is a need for more power density, and our researchers are delivering innovative and sustainable solutions. Their work will help mitigate pollution, increase energy efficiency, develop alternative power sources and enhance economic growth."

Nearly 20 full-time faculty members from across the college are leading the charge, enhancing the college's reputation as a pioneer and leader in battery efficiency, energy storage, alternative power sources and power distribution. Their research, conducted in partnership with various government agencies, foundations, companies and organizations, aims to change the way energy is produced, transmitted and consumed.

For instance, college researchers such as Simon Ng and Steven Salley continue their work on a class of catalysts that help convert

cost-effective raw materials into biodiesel through NextCAT. And college professors such as Amar Basu, Hamidreza Chitsaz, Weisong Shi and Jaewon Jang are busy addressing biotechnology for renewable biofuels, optimizing algae for biofuel production, minimizing energy consumption of mobile devices, and searching for sources of renewable energy via methane hydrates in oceans and permafrost, respectively.

New to the college's mechanical engineering faculty this fall, Leela Mohana Reddy Arava conducts research involving the development of green and sustainable lithium battery electrodes from natural resources. Meanwhile, Chemical Engineering Professor Eranda Nikolla's research on fuel cells aims to improve energy efficiency and storage through the development of robust electrochemical and photochemical energy systems.

Building on the college's expertise in energy storage, professors Le Yi Wang, Feng Lin and Caisheng Wang are working to improve battery performance in hybrid and electric vehicles. They hope to develop a real-time battery characterizer to solve issues such as extending the driving range of batteries, producing them at a lower cost and increasing their safety.

Caisheng Wang is also addressing the smart grid, along with fellow researchers such as Ali Tajer. Wang is hoping to enhance charging and power management strategies through microgrid projects that use smaller, sustainable generation sources to maintain power during outages. Tajer, meanwhile, is studying different aspects of cyber security in energy grids and investigating the fundamental gains of integrating intermittent resources into grids.

The college, home to the nation's first electric-drive vehicle engineering program and alternative energy technology master's program, is known as a primary center for alternative energy and electric-drive vehicle education in Michigan.



Wayne State's EcoCAR 2 team

It's a partner of the Michigan State Energy Sector Partnership, the Michigan Academy for Green Mobility Alliance, and the collaborative Southeast Michigan Advanced Energy Storage Systems Initiative (AESSI), which aims to create more than 54,200 new jobs and technologies related to rapidly emerging advanced energy storage systems in the region. It also partners with engineering, engineering technology and community college automotive programs, as well as industrial partners, to offer electric vehicle, hybrid electric vehicle and plug-in hybrid electric vehicle educational programs.

"The college is the hub of energy research and education in Southeast Michigan. We work closely with partners to better understand workforce needs and requirements, and develop curricula accordingly. We have expertise, innovation, industry and location on our side, which allows us to provide a remarkable education to our students," Fotouhi says.

Students such as Mengjia Cao and Junhui Zhao have benefited from the college's focus on energy-related coursework and opportunities to participate in competitions such as EcoCAR 2 and the Michigan Clean Energy Venture Challenge. Students also have access to hands-on research and, through the college's industry ties, countless internships and co-ops at heavyweight companies such as DTE Energy, TARDEC, General Motors, Ford Motor Company, BASF and many more.

"Wayne State is my dream school," Cao says. "It offers a one-of-a-kind program in electric-drive vehicle engineering, and its location means firsthand access to internship and job opportunities. On top of that, its involvement in the EcoCAR 2 competition has provided me with tremendous opportunities. I believe my experiences at Wayne State will enable me to dig right into a position in industry, and I look forward to building my career."

Adds Fotouhi, "With continued efforts by our faculty, alumni and students, there are really no limits for where our college community can go in enhancing quality of life through energy solutions." ❁



Professor Golam Newaz (left) and mechanical engineering Ph.D. student Ali Al-Sharif

MATERIALS AND MANUFACTURING:

Revolutionizing industry

The automotive industry is constantly searching for new lightweight materials to increase protection and improve fuel efficiency. Golam Newaz, professor of mechanical engineering in Wayne State University's College of Engineering, is leading the way in the research and development of these breakthrough materials.

Newaz and his collaborators are investigating and developing ultra-lightweight structural sandwich composite structures, which

could provide big benefits for automotive applications.

"These structures are common in aerospace applications and offer exceptional strength-to-weight ratios, but until recently had not yet been investigated and adapted for automobiles," says Newaz. "These structures achieve strength targets and accomplish weight reductions far beyond those feasible using present stamped steel and aluminum-welded car body construction methods."

The development of new materials is an important part of advanced manufacturing, and College of Engineering researchers are hard at work identifying structural components that are lighter and stronger, improve energy efficiencies, reduce emissions and pollution, increase safety, and cost less to produce.

Professor Susil Putatunda's research in creating advanced materials with high-yield strength, fracture toughness and ductility has led to the development of a new high-strength steel that is processed from traditional elements used in the steel industry and heat-treated using a two-step austempering process.

According to Putatunda, this high-strength steel has a number of advantages over what's currently used by industry.

"Our steel has twice the yield strength, a very high tensile strength and close to three times more fracture toughness over the advanced steels currently on the market," he says. "In addition, it has improved strength for fatigue and impact, and improved durability."

Meanwhile, students in Wayne State's Center for Automotive Research and Advanced Composites Laboratory are collaborating with world-renowned faculty experts and government and industry partners to identify next-generation needs, develop innovative new technologies and turn classroom ideas into real-world solutions. They are leading the way in breakthroughs that could revolutionize the industry.

College researchers also are pursuing developments that will benefit the growing number of smaller manufacturing facilities, which require flexibility, advanced automation, up-to-date robotics technology, and manufacturing platforms that are quickly and easily convertible for new uses. Flexible manufacturing is

essential to fabricating a greater variety of high-technology devices for biotechnology, clean energy and other industries within a smaller manufacturing footprint.

The college employs several expert faculty members in industrial and systems, electrical and computer, mechanical, chemical, and civil engineering to address these issues and the potential of advanced manufacturing — and their ranks continue to grow. New Department of Industrial and Systems Engineering Assistant Professor Jeremy Ricki's expertise in end-of-life product value recovery, manufacturing processes and system improvements could play a vital role in developing longer-lasting, more sustainable materials. Another recent addition is Assistant Professor Guru Prasad Dinda, whose knowledge of additive manufacturing will continue to keep Wayne State on the cutting edge as 3-D printing becomes more prevalent. These disciplines ultimately will result in major industry benefits.

"High-technology manufacturing will be a major growth sector for Michigan," says College of Engineering Dean Farshad Fotouhi. "As the college takes steps to enhance biomedical research and green technologies, forming partnerships and creating multiple startup companies, a small revolution in manufacturing in Southeast Michigan may emerge for products such as imaging equipment, energy storage systems and biofuels. As our influence in this area grows, we can serve as a leader and example for other manufacturing regions in the country that are striving for continued relevance."

Looking ahead, the college also seeks to create a state-of-the-art manufacturing laboratory to give students hands-on learning opportunities with 21st century versions of conveyors, robotics, and injection molding and 3-D printing machines. ✿



BIG DATA AND BUSINESS ANALYTICS:

Yielding big benefits

Associate Professor Jing Hua (left) and computer science Ph.D. student Hai Jin

Jing Hua, associate professor of computer science, is researching ways to combine networked camera feeds and enhanced graphics to conduct surveillance over large areas. This technology could allow police departments and government entities to search several city blocks without combing through hundreds of isolated feeds.

“On Wayne State’s campus, we have more than 500 surveillance cameras,” Hua says. “Combining these into one 3-D image uses a great deal of data. We’re one of the few universities to take an interdisciplinary approach to this, having visualists, graphics experts and analysts on our team.”

This is just one way in which College of Engineering researchers are revolutionizing the way data is compiled, sorted, analyzed and understood — an important discipline in a world where approximately 2.5 quintillion bytes of data are created daily.

“Ninety percent of the data existing today was created within the last two years,” says College of Engineering Dean Farshad Fotouhi. “Determining and extracting its value can give businesses major competitive and economic advantages when used creatively and efficiently.”

To reap these benefits, companies need scientists who can find and translate data patterns into purposeful business information. According to a recent article by *Harvard Business Review*, there are too few data scientists for this work.

“Wayne State students with the ability to ascertain and derive value from big data enter the marketplace with key educational and professional advantages,” Fotouhi says.

Many already are bringing their expertise into the professional world. Students Amit Rathi and Jian Deng have used image processing to obtain data from receipts to help businesses improve efficiency and service. Ken Thomas and Ted Pavlosky are developing an application that uses a taxi receipt and other information to plot an ideal route, allowing users to see whether their taxi went the proper way — and whether to frequent that service again.

Health care is benefiting from this research as well. Assistant Professor Hamidreza Chitsaz’s studies of single-cell genome sequencing and RNA structure are helping biologists better understand genetic-level interactions. Professor Sorin Draghici’s work with genome-level changes in cancer patients aims to pinpoint the moment when a system significantly changes from its healthy state, which could improve cancer diagnosis and treatment. And Associate Professor Ming Dong’s look at relational saliency in electronic medical records (EMR) could help physicians move a step closer to personalized medicine. During a December 2012 trip to Haiti, the School of Medicine’s World Health Student Organization tested EasyEMR, an open-source software program designed by computer science seniors. The software allowed the organization to easily compile and store medical records, leading to better patient care.

A proper understanding of processes, costs, requirements and anticipated problems is critical to running successful businesses.

Professor Ratna Babu Chinnam and Associate Professor Alper Murat’s work with big data and business analytics addresses a variety of critical areas, including health care analytics, warranty analytics, product assortment planning, freight logistics and supply chain management. This research could be vital to making businesses more efficient, cost-effective and customer-focused.

Using data to build better models can also serve as a sort of time travel, as Robert Reynolds’s research proves. The professor of computer science and his team used advance models to simulate how the ancient city of Monte Albán was formed, operated and ultimately collapsed nearly 2,500 years ago. This information could prove invaluable to researchers trying to determine how ancient cultures functioned.

Social media is a rapidly growing area of study. Facebook users alone generate 30 billion pieces of data every month. New faculty member Alexander Kotov’s research will dig into what this means, focusing on large-scale textual management with specific focus on interactive and intelligent search, social media search and analysis, textual data mining, and natural language processing. Furthering WSU’s social media research is Assistant Professor Chandan Reddy, whose work with Twitter data will lead to a better understanding of and solution to the information overload that can be caused by the site’s high data volume.

Going forward, the college hopes to create a big data center reaching throughout campus. Wayne State’s multitude of departments, databases and technologies is an ideal place for future data scientists to work on and present solutions to this important research field. ❁



AUTOMOBILE SAFETY:

Leading the way, mile by mile

Albert King's goal is to reduce fatalities and minimize injuries in automobile accidents.

"I am deeply committed to research that can prevent injuries during automotive crashes because, even with advances in active safety technology, crashes are still going to occur and occupant protection should not be de-emphasized," he says.

King, a member of the National Academy of Engineering, joined Wayne State University's biomechanics program in 1966 after earning his doctorate from the college, and has been

making his mark ever since. Even then, the college was well known for research in automobile safety. Its Bioengineering Center, established in 1939, was conducting pioneering studies of skull fractures and the use of human cadavers in automobile safety tests.

Over the decades, college researchers and alumni — eventually led by King, who has gone on to steer the center — have been known for developing air bags, seat belts, safety glass, collapsible steering columns, padded dashboards, frontal-impact crash dummies and many other safety features.

With such a robust foundation, WSU's position as a leader in driver and passenger safety has only grown stronger over the years. For example, King and Professor King-Hay Yang have developed computerized models of the effects of car crashes on the human body. As a result, engineers are able to account for a greater variety of impact scenarios when designing vehicle safety systems.

Additionally, college researchers are collaborating to develop active safety technologies to avoid collisions, better understand driver behavior and detect driver fatigue. Professor Mark Ming-Cheng Cheng's flexible and wearable sensors, for instance, could help pre-tense seat belts before an impact as well as monitor a driver's heart and respiration rates and stress level.

Professors such as Jing Hua and Nathan Fisher from computer science are zeroing in on drive active safety, virtual reality simulation, reaction time behind the wheel and algorithms for verifying timing properties of safety-critical systems. Future electronic device research by the Transportation Research Group, led by longtime transportation expert Professor Tapan Datta, could lead to fewer accidents in Michigan.

The wireless communication and real-time networked vehicle control work of professors Ming Dong, Le Yi Wang, Cheng-Zhong Xu, George Yin and Hongwei Zhang is pushing the boundaries in vehicle-to-vehicle communication and autonomous vehicle development and innovation.

And professors Golam Newaz and Xin Wu could transform automobiles and enhance vehicle safety through the use of advanced lightweight component design and manufacturing technologies.

"With advances in technology, more researchers from across the college are involved in automobile safety innovation," said College of Engineering Dean Farshad Fotouhi. "We have some incredible minds doing a wide variety of amazing work. It continues to make us stronger, enabling us to better connect with industry and better educate and prepare our students."

What's more, the college collaborates with a large number of companies, organizations and governmental agencies to address challenges, realize trends and offer solutions.

Students such as undergraduates Abigail Davidson, Stan Marek and Abrar Wazir are involved in research and offered internship and co-op opportunities with companies such as Chrysler, Ford, General Motors, Takata Corp., TRW Automotive, Faurecia, Lear, Delphi and many more thanks to the college's strong reputation.

"I have learned a great deal about biomechanics and human safety from Dr. Yang," says Wazir, who works closely with Yang and has served for the last two years as a vehicle safety engineering intern at GM. "His biomechanics work has transformed automobile safety, and it's been a privilege to learn directly from him and use that knowledge on-site in my internships at GM."

Located in the heart of the Motor City, the college shows no signs of slowing down. Its faculty, alumni and students — building on the college's robust automobile safety history — continue to push boundaries and investigate the needs and anticipated deliverables of automobile companies while advancing technologies and systems designed to avoid collisions and save lives. 🌟

Professor Albert King (right) and biomedical engineering Ph.D. student Ke Feng



ENGINE OPTIMIZATION:

The kind with horsepower

Professor Naeim Henein (left) and mechanical engineering Ph.D. student Shenouda Mekhael

Mention engine optimization these days and minds instinctively turn to the Internet and improving the visibility of websites. But here in the Motor City, and especially at Wayne State University, engine optimization is defined literally.

When WSU College of Engineering faculty members and students talk about engines, they usually mean the kind that generate hundreds of horsepower. And when they talk about optimization, they mean incorporating the latest research into engines and finding new ways to make them lighter, quieter, cheaper and more fuel efficient.

Take the College of Engineering's Center for Automotive Research (CAR) for example. Research conducted here by faculty members such as Naeim Henein, Nabil Chalhoub, Marcis Jansons and Dinu Taraza prepares students to solve practical problems in areas such as the effects of diesel fuel properties, total engine friction, flexible body approaches, and multicylinder turbocharged and intercooled heavy duty engines, to name a few.

Today, CAR is developing programs to support comprehensive, integrated fuel testing feedback for the military and the automotive industry, including research that could lead to omnivorous engines in the future. That is, engines that can detect what type of fuel is being introduced and calibrate themselves to burn that fuel in the most efficient way possible.

Henein, director and founder of CAR, sees engine optimization as key to continuously maximizing the potential of a vehicle's performance. "Optimization is a necessity in order to develop the most efficient engines at a reasonable cost," he says.

CAR's research in the area of engine optimization reaches far beyond improvements in fuel economy. Henein adds, "Our research covers combustion,

performance, emission controls, friction and wear, and simulation of automotive engines, as well as alternative and renewable fuels and biofuels. The Center for Automotive Research is seen as a key contributor to engine optimization for the entire automotive industry."

Combine that with research by Professor Sean Wu — creator of SenSound software, systems, and services for noise source identification and noise-related quality control testing — and Professor Golam Newaz — developer of lightweight structural composites for automotive applications — and it's a recipe for innovation and job creation.

It's also a plus for the College of Engineering and the industry it serves that WSU is in Detroit. "Our location encourages collaboration with industry and provides a prime area of growth for our department and for our students," Henein says.

Because the college is in the heart of the Motor City, Henein believes WSU engineering students are exposed to opportunities that students at other colleges never see. This makes them better prepared for a career in automotive engineering. "Students leave here very well equipped to step right into an engineering career, because we talk to our students with the language of industry that surrounds us," says Henein.

Today's engineering employers are no longer interested in a student who has only read about engineering challenges. They're seeking graduates who have gained valuable problem-solving experience in the lab. "At CAR, no student gets out of here just doing paperwork," Henein says. "Student success comes from three key components: theory, computer simulation and hands-on experimentation."



Formula SAE

Farshad Fotouhi, dean of the College of Engineering, encourages a strong emphasis on experiential learning. “From national engineering competitions and building Formula-style racing cars, this is the type of hands-on exposure that not only do employers demand from graduates but graduates should demand from their educational experience,” Fotouhi says. “It’s a necessity in order to be one of tomorrow’s top engineers.”

All of this can be intriguing to prospective students. But what makes WSU’s College of Engineering different from other engineering schools? Henein says it boils down to an innovative faculty, a supportive university and some of the best-equipped labs in the country.

“Whether it’s engine optimization or another type of research, the work being done at CAR is relied on every day by the automotive industry and by our military,” Henein says. “They’re very interested in incorporating what we discover from our research today into their engines of tomorrow. The competition is just that fierce. It’s good for industry, for Wayne State’s College of Engineering and, most importantly, for our students.”

Wayne State’s engineering faculty played a large role in this year’s Transportation Research Board Annual Meeting in Washington, D.C. The program attracted nearly 12,000 professionals from around the world, some of whom contributed to Wayne State research during the weeklong event as part of a national focus group for the university’s Federal Highway Administration Work Zone Safety Grant project.

“These experts provided important feedback to help guide our work zone safety guideline and software development, training efforts, and related policies and programs across the country,” says longtime College of

Engineering Professor Tapan Datta, who leads the project. “Ultimately, these efforts will help to reduce highway work zone crashes, injuries and fatalities.”

Datta directs the WSU Transportation Research Group, which has conducted critical and innovative research on a wide range of traffic operational and safety issues, including work zone, highway and pedestrian safety. Most recently, Datta worked with the Michigan Department of Transportation on a major construction project to make a busy stretch of Wayne State’s campus friendlier for pedestrians and cyclists.

Professor Tapan Datta (right) and student Hassan Dakroub

Joining Datta in D.C. were four full-time faculty members, one professor emeritus, one alumnus, nine students, and Department of Civil and Environmental Engineering Chair Joseph Hummer.

This formidable presence at a major industry event comes as no surprise to Hummer. “We are involved in some remarkable transportation projects,” he says. “This forum gives us the opportunity to share our findings, learn from our peers, find new and exciting areas for potential collaboration, and bring new knowledge back into the classroom.”

An international leader in the development and testing of unconventional intersection and interchange designs, Hummer is perhaps the world’s most vocal advocate for the “Michigan left,” the median U-turn ubiquitous on state roads.

With the help of a grant from Science Applications International Corporation, Hummer’s team will develop equations, text and software so that the Michigan left turn and three alternative designs can be included in the next edition of the Highway Capacity Manual used by highway designers. Once the manual is updated with the Michigan left, the intersection design could be the Motor City’s next big export.

“We hope that in the future when people think of products from Michigan, they think of autos, cherries — and Michigan left turns,” says Hummer. Love it or hate it, the Michigan left has proven to significantly reduce traffic accidents resulting from turns at busy intersections.

Also up for study at Wayne State is whether posting different freeway speed limits for cars and trucks makes roads safer. Associate Professor Peter Savolainen and Associate Professor Timothy Gates are taking a comprehensive approach to answering that question for state officials with a grant from the Michigan Department of Transportation (MDOT) to review previous research, survey

trucking industry groups, collect historical and new field data from Michigan and other states, and use these data as part of a statistical analysis.

Differential speed limits, such as the ones in Michigan and Indiana, were set based on the idea that trucks require greater time and distance to stop due to their size. Larger vehicles tend to result in more severe injuries when involved in a crash. Savolainen says this is particularly relevant in Michigan because its truck weight limits are the highest in the country. “That’s just basic physics,” he says. “Additionally, fuel economy and environmental impacts tend to degrade at higher speeds.”

A uniform speed limit for cars and trucks, on the other hand, addresses the concern that varying speeds may increase the potential for collisions. Further, higher speed limits tend to reduce travel times, creating potential economic benefits for the freight industry.

Michigan legislators have said that they want to make data-driven decisions, and MDOT officials want to use the Wayne State study to examine the possible effects of speed limit policy changes.

Saving lives on the road is the ultimate goal of transportation researchers. Gates is also investigating the correlation between sight distance and intersection safety.

“Our purpose is to determine if there’s truly a relationship between crash occurrence and amount of available sight distance at stop-controlled intersections,” says Gates. “We’re trying to fit another piece into the safety puzzle that had not yet been addressed at a nationwide level.” ❁



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