# CONNECTING INNOVATION, HEALTH TO HUMANITY & THE ENVIRONMENT

DEAN'S REPORT 2013



**Engineering Excellence** We are in the middle of an exciting period of growth at the School of Engineering and Applied Sciences, and I am very excited to be a part of the process. President Obama's visit to UB in late August animated the campus

keeping a college education accessible to all, regardless of wealth.

We are deeply proud of the fact that we provide students with a fantastic engineering education without high tuition costs. This clearly resonates with today's students and their families, as we enrolled our largest ever class of engineering students for the 13/14 academic year. As a result, our seven departments and six buildings are buzzing with activity all day long.

with a discussion on the importance of STEM education and, in particular, on

Adding to the excitement, 20 energetic new faculty members have joined our school. Chosen for their outstanding research achievements to date and for what they will contribute to engineering, to UB and to their professions, our new faculty members will lead us in new directions and push us to ever greater achievements. We are delighted to welcome them to UB.

**Experiential learning is a key educational component in the training of engineers.** This year we are broadening the experiential learning opportunities for students in close partnership with our alumni, who are well represented across the entire spectrum of engineering industries.

In parallel with these activities, we have engaged deeply in a campuswide effort to define the strategic vision for the University, summarized in "Realizing UB2020," and available online. Five themes have emerged – Innovation, Health, Justice, Humanity and Environment – and our school seeks to contribute in very significant ways to each of them.

This brochure presents an overview of our exciting new initiatives – please see our website for more detail.

Liesl Folks, PhD, MBA Dean, School of Engineering and Applied Sciences



# Our graduate students, Hovannes Kulhandjian and Zahed Hossain, are working with their advisors to develop a deep-sea Internet. This breakthrough will lead to improvements in tsunami detection, offshore oil and natural gas exploration, pollution monitoring and other activities.

The Best Public Universities Have the Strongest Private Support

Your philanthropic support is critical to our success, allowing us to achieve greatness in education and research. In our complex world, we recognize that students need an ever more sophisticated education to have



"We offer

students

understanding of how

engineers

solve real

problems

every day,

for the

of humanity.'

the maximum impact. UB Engineering aims to meet this demand by increasing the number of doctoral graduates by 33% over the next three years, and we need your help to reach this ambitious goal. Your participation, at any level, is greatly appreciated.

We thank all our donors, especially members of the Delta Society – those who give \$1,000 or more annually – whose investments make the "difference" for our school. Donate and view our member list today at www.giving.buffalo.edu/delta-society.

### UB School of Engineering and Applied Sciences Thanks Open House Sponsors Nationalgrid

SEABURY APG value centric

NORTHROP GRUMMAN

61<sup>st</sup> best engineering school<sup>1</sup>
3<sup>rd</sup> best among public universities for students graduating with least debt<sup>1</sup>
33<sup>rd</sup> out of 100 best value public colleges<sup>2</sup>
Top 200 universities worldwide<sup>3</sup>
22 is the number of places UB Engineering has risen in international rankings<sup>1</sup>
\$4.8 million donated to UB Engineering in 2013<sup>4</sup> – a 40% increase over 2012
36% increase in Delta Society membership since 2011
Member, American Association of Universities



\$60 million annual research expenditure 159 faculty<sup>5</sup> (up 28% in the last 6 years) 28,000 alumni in 50 states and 65 countries

<sup>1</sup>US News & World Report, 2013 <sup>2</sup> Kiplinger's Personal Finance, 2012 <sup>3</sup> Times Higher Education World University Rankings, 2012-13 <sup>4</sup> Fiscal Year <sup>5</sup> Fall 2013

"Today I'm proposing major new reforms that will shake up the current system, create better incentives for colleges to do more with less and deliver better value for students and their families."

- President Barack Obama UB Alumni Arena, August 22, 2013



# 20 New Faculty

## **IMPROVING HEALTH AND TREATING DISEASE**



#### Healthcare Management

"I explore the role of big data in improving quality and reducing inefficiencies in healthcare. I design and develop scalable machine learning algorithms that can

handle the volume and variety in the data, and am investigating 'coordinated machine learning' to quantitatively understand the relationship between social behavior and public health using data."

- Varun Chandola

**Computer Science and Engineering** 



#### Using **Biomaterials** in Engineering

'My research involves stressing tissues to better understand cell and tissue mechanics using novel magnetic microsystems, and

the fabrication of biomaterials for tissue engineering. I also perform research in the fields of cardiovascular regenerative medicine, cancer mechanobiology and anti-fibrotic therapies."

- Ruogang Zhao **Biomedical Engineering** 



that sends reports to the doctor via cell phone. I work with clinical physicians to develop solutions that save patients' time, money and lives, and some of my research products have been commercialized.'

- Wenyao Xu

**Computer Science and Engineering** 



#### Stroke Diagnosis and Treatment

'Better imaging and better devices are key to improving the diagnosis and treatment of cerebral stroke. My research focuses

on these areas through the development of x-ray detectors for diagnostic and interventional neurovascular imaging, and the development and evaluation of endovascular devices." - Ciprian (Chip) Ionita

**Biomedical Engineering** 

#### "Smart" Devices

"My research focuses on nexttechnologies, such as a "smart cane" that provides feedback to help senior adults avoid falls, or a nanosize heart monitor

# - Anthony Tessari

**Civil, Structural and Environmental Engineering** 

#### Wind Energy



"My research focuses on modeling techniques and design methodologies for complex systems. It further facilitates system optimization with respect to control development, machine design, and multiphysics engineering

phenomena. My work is being applied in the area of renewable energy and currently targets the development of distributed wind turbines that are efficient, reliable and affordable." - John Hall

**Mechanical and Aerospace Engineering** 



#### **Early Detection and Treatment of Cancer**

"Nanoparticles can be used to fight cancer but, uncontrolled in the environment, they can be a health risk. My research spans these areas to include developing multifunctional nanoparticles-based theranostics, as well as studying the toxicology of nanoparticles." - Yun Wu

**Biomedical Engineering** 

# **INNOVATION TO ACHIEVE**



#### Expanding Wireless Networks

"Research on the interactions between nanoscale materials and terahertz radiation may lead to advances in materials designed to harness the still untamed terahertz band

of the electromagnetic spectrum. My research focuses on developing promising applications such as dense wireless networks able to handle 100 times more data traffic than today."

- Erik Einarsson **Electrical Engineering** 

generation healthcare

# SUSTAINING AND IMPR

**Natural Hazards** 

"The soil-foundation systems that are used in critical infrastructure to mitigate the effects of natural hazards are the focus of my research. I am currently working on physical modeling of the long-term behavior

of new floodwall systems in New Orleans, which will affect the safety and economic viability of the region for future generations."

# OVING OUR ENVIRONMENT



#### Green Design

"I am developing analytical models to tackle the complex problem of making end-of-life products recovery profitable while minimizing environmental impact. Electronic waste recovery,

green design under uncertainty, sustainable manufacturing, remanufacturing, and energy engineering are among my research interests." - Sara Behdad

**Mechanical and Aerospace Engineering** 



by mapping a building on fire, entering hazardous environments such as the Fukushima Daiichi Nuclear Power Plant and tracking chemical plumes."

- Karthik Dantu

**Computer Science and Engineering** 

#### **First Responders**

'I am interested in designing large-scale systems with computing, communication, sensing, and actuation. In particular, I am interested in designing swarms of micro-flying robots. These swarms could help future first responders

processes for gas and liquid separations. It will advance understanding of the technology and expand its applications in meeting the ever growing need for clean energy, air and water." - Haiging Lin

**Chemical and Biological Engineering** 



#### Resilience

"Developing innovative and cost-effective methods to enhance the resilience of the built environment is the overarching goal of my research. I focus on the condition assessment and rehabilitation of

aging bridges and buildings. I also analytically and experimentally investigate their structural performance under extreme loads."

- Andreas Stavridis

**Civil, Structural and Environmental Engineering** 



#### **Renewable Fuels**

"Finding environmentallyfriendly solutions to the world's energy problems is my research goal. To that end, my research focuses on designing more efficient and sustainable combustion systems and strategies

as well as developing next-generation renewable fuels for power generation and transportation through the use of innovative laser diagnostic techniques."

- Jihyung (Jonathan) Yoo Mechanical and Aerospace Engineering



"My research focuses on the development of energy harvesters to convert ambient energy to electrical power. My research interests include the development of innovative nonlinear

Clean Air, Water

and Energy

"Membrane is an

energy efficient and

separation process.

My research focuses

on the fundamental

study of membrane

materials and

environmentally benign

generators to power implantable medical devices and to harness energy from wind and ocean waves. The devices use smart materials as converting elements."

- Amin Karami

**Mechanical and Aerospace Engineering** 

## **FANGIBLE BENEFITS**



### Information

"The concept of 'Information' plays a major and ever increasing role in modern day to day life. My research focuses on the mathematical foundations of information and, in particular, on the design and analysis

of efficient and reliable schemes for the communication, representation, and storage of information."

- Michael Langberg
- **Electrical Engineering**



#### Wireless Communications and Networking "How can nanotechnology-

enabled ultra-broadband communication systems in the terahertz band be used to improve wireless communications and networking? I am

investigating how to leverage the tools provided by nanotechnology to define new networking paradigms with transformative applications, such as high-definition holographic videoconferencing on smartphones."

- Josep Miquel Jornet **Electrical Engineering** 

# **Technologies** "My research

involves developing novel additive manufacturing technologies (3D printing) which leverage modeling, optimization and

Manufacturing

simulation tools. This research has the potential to improve quality of human life by creating living tissues and organs, as well as supporting economic growth by allowing mass customization with substantially shortened product life cycle and reduced cost."

- Chi Zhou

**Industrial and Systems Engineering** 

#### **Smart Materials**

# 6 New Initiatives

# LINKING ENGINEERING EDUCATION AND TECHNOLOGY TO HUMANITY



#### Infrastructure Management

"An integrated infrastructure management decisionmaking system that encompasses design, funding, construction and operation as well as safety, preservation,

management and crises is my research vision. Using computational methods together with simulation and technology tools, my goal is to provide solutions that are environmentally friendly, energy efficient, reliable, sustainable, safe, livable, and publicly acceptable."

- Panagiotis Ch. Anastasopoulos

Civil, Structural and Environmental Engineering



#### High Performance Infrastructure

"The focal purpose of my work is to ease our aging infrastructure's burden on the economy, traveling public and the environment by understanding the

fundamental structural behavior of reinforced and prestressed concrete bridge structures. I use analytical and physical simulations to develop analysis and design methods for durable, innovative, sustainable and rapidly constructed highway bridge structures."

- Pinar Okumus

**Civil, Structural and Environmental Engineering** 



#### Transportation Sustainability

"My research interests include travel demand modeling, transportation network problems, applied operations research and sustainable transportation.

In particular, my transportation sustainability work has influenced the real-world implementation of a sustainable transportation system. A paper that I co-authored was adopted by the California Fuel Cell Partnership to identify 68 hydrogen refueling stations in California."

- Jee Eun (Jamie) Kang Industrial and Systems Engineering



#### Reducing Health Care Costs: Health and Wellness in the Home

Home health and wellness is essential for reducing health care costs, creating lifestyle choices that improve individual health, and supporting independence for aging or functionally limited populations. Home Health and Well-Being through Adaptive Smart Environments (Home-BASE), is developing research and education programs in three areas:

- Environments for health and well-being
- Integrated assistive technologies
- Home health informatics

Home-BASE is a joint initiative between the Schools of Engineering, Nursing, Architecture and Planning, and Public Health & Health Professions.



# Diversity and Inclusion in Engineering

Buffalo provides a unique environment to foster graduate students from diverse backgrounds into becoming future leaders in science and engineering. The **Institute for the Strategic Enhancement of Educational Diversity (iSEED)**, a UB-wide initiative, is building a community of students, postdoctoral fellows, faculty, and staff focused on excellence in education, engagement in research, mentoring and enhancement of professional development.



#### **Engineering Teaching and Research Areas**

Aerospace Engineering Bioinformatics Biomedical Engineering Chemical Engineering Civil Engineering Computer Engineering Computer Science Electrical Engineering Engineering Physics Environmental Engineering Industrial Engineering Materials Science and Engineering Mechanical Engineering





#### **Bridge and Infrastructure Renewal**

The **Institute of Bridge Engineering (IBE)** is educating new and mid-career individuals in emerging aspects of bridge engineering and conducting research that can advance the state-of-the-practice in the design and retrofit of bridges. The IBE aims to:

- Develop technologies for low-impact (rapid construction and environmentally sensitive) bridges that are resistant to hazards
- Disseminate educational material useful to engineers and DOTs
- Increase the availability of a specialized master's degree to distance learners
- Deploy reliable decision-support systems





# Harnessing Big Data and Computation

Over the last few years, hurricanes and tornadoes are being predicted with greater accuracy; complex simulations are being used to design and test cars, planes and space vehicles before fabrication; crowds with thousands of people are kept safe by active monitoring for bad actors – all made possible by revolutions in science/engineering driven by the use of big data and computation. A new interdisciplinary graduate degree and certificate program in **Computational Data Science and Engineering (CDSE)** is being developed to train scientists and engineers to lead in these disciplines.



#### **Transportation and Logistics**

Transportation, logistics and supply-chain management represent a field of inquiry with tremendous potential impacts on our economy and society. To develop a structure for research and education in this field, UB has created the **Institute for Sustainable Transportation and Logistics (ISTL)**. The ISTL unites faculty groups in transportation and logistics to address this growing new field, and to educate students in a holistic manner by integrating engineering and management skills into a signature master's degree program.

#### NEW UNDERGRADUATE PROGRAM

#### **Enhancing Academic Learning Through Real-World Experiences**

SEAS **Experiential Learning Programs** are focused on initiatives that enhance the academic experience for students by connecting the classroom to the real world. Young engineers are encouraged to develop the right balance of

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technical expertise, practical perspective and professional decorum. Upon graduation, students will receive a co-curricular record of their participation in these programs, along with their official university transcript.



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#### "The many career-oriented activities offered at UB definitely enhanced my resume."



# Her Career is Off to a Running Start

#### Summer internship leads to job at Fortune 500 company

As Samantha Beim neared the end of her junior year in mechanical engineering, she decided to do a summer internship at John W. Danforth, a Buffalo-based company that specializes in HVAC and plumbing. There, she had an opportunity to see firsthand the type of work engineers do in the real world, and how they interact with project managers out in the field.

The following spring, with graduation just a few short months away, Sam went to a UB Career Fair, where she met with representatives from Cameron International, a Fortune 500 company headquartered in Houston. Impressed by her industry experience, they offered her a spot in their Global Rotational Development Program (GRDP), a two-year training program for new college graduates.

Sam has been at Cameron for a few months now, and said "having relevant work experience to back up my education definitely influenced how and why I got this job. My internship not only gave me experience in industry, but also exposed me to the management side of engineering. This piqued my interest, and led me to specifically look for programs like the GRDP as a career option."