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Education – Lehigh University, Bethlehem, Pa

Doctor of Philosophy, Mechanical Engineering – 3.81 GPA (January, 2017)

- Areas of concentration: Smart product development, mechatronics, engineering education, and technical entrepreneurship

Master of Engineering, Mechanical Engineering (5/14)

Bachelor of Science, Mechanical Engineering major, Electrical Engineering minor (9/12)

Doctoral Work

Entrepreneurially Minded Engineering Design & Development of a Novel Snake-like Robot

- Invented 1 inch diameter robot that is able to see, drive, and drill in walls to pull wires
- Created new graduate program called Entrepreneurially Minded Dissertation (EMD)
- Patent pending
- Additional applications of technology:
 - Disaster relief – locating and remotely assisting trapped persons
 - Home inspection – looking for issues within walls
 - Space exploration – next generation of robotic arms for space exploration
 - Bionics – new high force, agile prosthetic limbs and assistive devices
- Self-sponsored and funded project – Lehigh University has no ownership of the technology thus patent is wholly owned by Matthew Bilsky/Impossible Incorporated LLC
- Raised over \$200,000 in non-dilutive funds
- 2nd place in 2016 Lemelson-MIT Student Inventor Competition

Awards/Honors

River Guide of the Year – Voted by the staff of Pocono Whitewater (8/18)

John B. Ochs Award for Faculty Achievement in Entrepreneurship Education (4/17)

Lemelson-MIT Student Inventor Competition – National Finalist (2nd place) (1/16)

- Based on portfolio of inventions, commercialization, systems thinking, and mentorship

Homewood International Society of Automation Engineering Scholarship (4/12) - \$1000

Eagle Scout, Boy Scouts of America (4/06)

Grants

Pennsylvania Infrastructure Technology Alliance (PITA) Grant (1/19)

- \$44,000 to support the development of the snake-like robot and open source instrumentation tools as a collaboration between Impossible Incorporated LLC, Professor Brandon Krick, and the Technical Entrepreneurship (TE) Master's program at Lehigh University

South Side Bethlehem Keystone Innovation Zone (KIZ) Technology Transfer Grant (4/18)

- \$15,000 awarded to Impossible Incorporated to finance the foreign patents of the snake-like robot

Pennsylvania Infrastructure Technology Alliance (PITA) Grant (1/18)

- \$40,000 to support the development of the snake-like robot as a collaboration between Impossible Incorporated LLC and Professor Subhrajit Bhattacharya at Lehigh University

Penn State Lehigh Valley LaunchBox Grant (12/17)

- \$5000 to support development of snake-like robot

Pennsylvania Infrastructure Technology Alliance (PITA) Grant (1/17)

- \$49,940 to support the development of the snake-like robot as a collaboration between Impossible Incorporated LLC and Professor Brandon Krick at Lehigh University

Moravian College Graduate Business Program Strategic Business Projects (1/16-5/16)

- One of two companies selected to receive a team of 5 MBA students to refine and address Impossible Incorporated LLC's strategic goals

Eureka! Ventures Competition – Legacy Award Recipient (11/15)

- Received 2 Integrated Product Development (IPD) undergraduate student teams to continue developing wall scanner and robot user interface

South Side Bethlehem Keystone Innovation Zone (KIZ) Technology Transfer Grant (3/15)

- \$15,000 awarded to Impossible Incorporated to finance the development and patenting of snake-like robot

KIZ Student Internship Grants

- \$2500 to hire an undergraduate mechanical engineering student (summer, 2017)
- \$5000 to hire a graduate mechanical engineering student (fall, 2015)
- \$2500 to hire an undergraduate electrical engineer student (summer, 2015)

Lehigh Valley Economic Development Corporation (LVEDC) Student Internship Grant

- \$2500 to hire a recent mechanical engineering graduate (summer, 2015)

Eureka! Ventures Competition – 1st Place, Levin Advanced Technology Prize (11/14)

- \$3000 cash to support robot development costs
- \$7500 in-kind
 - Co-working space at Ben Franklin Technology Partners
 - 2 Integrated Product Development (IPD) undergraduate student teams to develop a scanner capable of mapping structural members and obstacles in walls

United States Economic Development Authority (USEDA) Grant (1/14-12/14)

- Student IPD team to work on developing drill robot's user interface
- \$2500 to hire mechanical engineering summer intern

Teaching Experience

Full-time Adjunct Professor – (8/16-12/18)

- Hired as faculty member during last semester of graduate program for excellence in teaching and mastery of Technical Entrepreneurship and Mechatronic Dynamic Systems
- TE 211/212 – Professor of Integrated Product Development (IPD)/Technical Entrepreneurship (TE) Capstone Course
 - Lecture and organize over 200 students across 31 teams
 - Supervise 20+ other team advisors and senior peer mentors
 - Lead weekly meetings to develop course policy and steer towards learning outcomes
- ME/MSE/TE 401 – Professor of Graduate Core Course – Graduate IPD
 - Co-teach with Mechanical Engineering Faculty Member over 50 Graduate Students from Mechanical Engr., Manufacturing Systems Engr., and TE Masters programs
- ME 207 – Professor of Senior Dynamics Lab
 - Instruct two 20 student lab sections and supervise course teaching assistant
- ME 374 – Mechatronics Lab
 - Project based senior elective that teaches the fundamentals of mechatronics, smart product development, and technical entrepreneurship

Integrated Product Development/Technical Entrepreneurship Capstone –

TA & Advisor (8/13-5/16)

- Two semester Junior/Senior capstone design course for Mechanical, Material Science, Biology Engineers along with Supply Chain Management and Marketing students
- Students work in teams of 6-7 on industry sponsored projects
- Teaches product development in a business context – Customer driven design
- Switched course and users (250+) from clunky Course Site software to Google Drive for group project file sharing greatly increasing the efficiency and ease of use for both students and advisors

Lehigh Kern Entrepreneurial Engineering Network (KEEN) Initiative (6/15-12/18)

- \$200K grant for instilling the entrepreneurial mindset in engineering undergraduates
- One of 12 KEEN Faculty Champions across Engineering disciplines tasked with creating a dialog within and between departments to increase overall student engagement and knowledge retention through Entrepreneurial Minded Learning (EML)
- Only non-professor/faculty member while graduate student
- Attended and exhibited at national winter meeting (1/16,17,18)
- Participated in KEEN 1 week Entrepreneurial Minded Learning/Project Based Learning pedagogy and implementation workshop at Lawrence Technical University (6/15)

Entrepreneurial Minded Learning Course Design – ME 207 Senior Dynamics (6/15-5/18)

- Re-designed course to apply KEEN principles/Entrepreneurial Minded Learning
- Students begin by learning how to model and collect parameters of DC motors using Simulink software and Teensy microcontrollers
- Using their new knowledge of motors they construct a crane under real world conditions such as weight and complexity restrictions
- A competition is held at the end with the winner being the team whose crane is the lightest, simplest crane that can lift a weight the fastest while being the most accurate simulating the many costs and values that must be considered in the real world
- Supervised fellowship student through KEEN grant to create a simplified version of the course for outreach programs such as PreLUision and CHOICES (summer, 2016)

Guest Expert Lecturer for Graduate IPD on prototyping and concept testing (fall, 2014,'15)

Lehigh Graduate Student Teacher Development Program – Levels 1 & 2 (2014)

Mechatronics Lab Manager (5/13-8/18)

- Provide consultations on technical projects for students, professors, and teams
- Maintain inventory, organization, procurement, and maintenance of lab and equipment
- Ad-hoc Teaching Assistant for Senior Dynamics Lab (ME 207) and Mechatronics (ME 374) which take place in lab

Work Study and Independent Study Supervisor (1/15-12/18)

- Mentored both Electrical and Mechanical Engineering students using project based learning to teach Mechatronic concepts
- Advised two Senior student entrepreneurs for ME 310, independent study, so they can develop their product and biomedical technology start-up

TA - Engineering 10/97 Introduction to MATLAB and Arduino for freshman (1/13-6/14)

- Brought Arduino and Teensy across the curriculum through course development
- Revolutionized the grading system by giving each student a card to track their progress through the course's lab exercises allowing for instant feedback to both students and teachers. This system also reduced weekly grade input time from 2 hours to 20 minutes
- Upgraded electrical and electronics in course's final Arduino projects

ME 374 Mechatronics Lab course (summer, 2012)

- Designed and wrote entire set of PowerPoint based self-paced lecture slides
- Utilized flip-the-classroom model where students work from PowerPoints on their own then ask professor/TA remaining questions
- Project based learning where fundamental mechatronics skills are taught through students building their own thermal chamber

ME 387 Digital Control Systems (winter, 2011/12)

- Developed library for Simulink Arduino Target to allow multiple servos to be controlled simultaneously
- Adapted course to use Arduino for real-time control implementation from Simulink software

Employment History

Lehigh University (11/11-12/18)

*Full Tuition & Stipend

**Summer Stipend

- Post-Doc Research Associate and Adjunct Professor (1/17-12/18)
- Full-time Adjunct Professor (8/16-1/17)
- Teaching Assistant and Advisor* (1/13-5/16)
- KEEN Faculty Champion** (6/15-12/18)
- Dean's Doctoral Assistant* (8/12-12/12)
- Course Designer – ME 374 Mechatronics Lab** (summer, 2012)
- Grader – MECH 102 Dynamics (spring, 2012)
 - Wrote literal solutions manual to accompany book's answer key
 - Position is normally reserved for graduate students
- Course Designer – ME 387 Digital Control Systems (winter, 2011)

Impossible Incorporated LLC – Founder (12/13-Present)

- Provides specialty engineering design and product development services
- Mechatronics and smart product develop consulting services
- Recipient of numerous small business development grants
- Employs student interns giving them the opportunity to apply their classroom knowledge in real world product development and technical entrepreneurship settings
- Sponsors and mentors Entrepreneurial Minded Learning through IPD program

Pocono Whitewater – Trip Leader (6/09-Present)

- Lead 120 guests and 3 additional guides on class II/III whitewater rafting trips
- Responsible for training new guides and teaching existing guides how to lead their own trips
- One of a select few guides who lead the company's premier trip, the Big Day Out, consisting of biking, hiking, and rafting

United State Collegiate Ski and Snowboard Association (USCSA) – Volunteer Alpine Ski Race Official (9/12-Present)

- Organize student volunteer gate keepers and process race disqualifications
- Ensure a safe of course for all competitors
- Mentor new and inexperienced racers
- Provide music for events

5th Street Capital Partners – Superintendent of Properties (5/10-8/14)

- Helped grow company from 8 to 35 houses during employment
- Construction managed and participated in the renovation of over 30 50+ year old homes
- Managed 35+ houses and company office/apartment building
- Provided routine maintenance along with on-call emergency repairs and lock-outs

Mattcomp Services LLC – Owner and Licensed Contractor (1/03-Present)

- Computer hardware/software repairs, upgrades, maintenance, and implementations
- Web design and hosting solutions
- Network, video, home theater, and telecom installation including cable/electrical runs
- Construction management, project management, and handyman services

Aalta Sports (11/07-4/08)

- Assistant store manager of ski rental shop in the village of Beaver Creek, CO
- Worked with adhesive label company to design rental ski identification tag that can withstand the wear from skiing yet be easily removed by shop technicians

Research Experience at Lehigh University

Self (6/13-Present)

- Visiting Research Scientist (1/19-Present)
- Post-Doctoral Research (1/17-12/18)
 - Continued development of snake-like robot
 - Publications from dissertation
 - Federal grant writing
 - Research into effect of active/collaborative learning techniques on student engagement during lectures
- Graduate Research (6/13-12/16)
 - First PhD candidate to propose, sponsor, conduct, and patent their own dissertation research in the Mechanical Engineering Department
 - Graduate Advisor: John B. Ochs, Professor, Director of Integrated Product Development and Master of Engineering in Technical Entrepreneurship programs
 - Committee Members (Faculty of Lehigh University):
 - N. Duke Perreira – Dynamic Systems and Mechatronics, Mechanical Engineering
 - Brandon Krick – Tribology, Mechanical Engineering

- Wesley Heiss – Product Development, Assistant Chair of Art, Architecture, and Design
- Defended November 18, 2016

Professor John Coulter (1/13-6/13)

- Modeling and improvement of melt flow in injection molding systems

Professor Yaling Liu (8/12-12/12)

- Design of micro-fluidic devices for early circulating tumor cell detection

Professor Terry Hart (8/11-12/11)

- Hopper Space Simulator/Lunar Lion Google X-Prize Team
 - Developed method to interface the hardware and software of the Hopper allowing for control algorithms to be written and compiled in Simulink then executed on an on-board embedded computer enabling them to control the servos, sensors, and thrust fans in real-time

Conferences and Presentations

University Economic Development Association (UEDA) 2018 Summit (10/18)

- 5-minute lightning round talk: “Empowering Student Start-ups Through the Economic Development Ecosystem”

Lehigh Mechanical Engineering Graduate Student Seminar Series (4/18)

- Presented guest seminar on “Demystifying Engineering Design Through T-Shaped Systems Thinking”

KEEN 2018 Winter Conference, Dallas, TX (1/18)

- Delivered two workshop talks:
 - Direct, Authentic and Formative Assessment of Entrepreneurial Mindset Learning (with Jerry Lennon and John Ochs)
 - Developing the Next Generation of KEEN faculty (with John Ochs)

Lehigh Mechanical Engineering Graduate Student Seminar Series (11/17)

- Presented guest seminar on “The Mindset of T-Shaped Systems Thinkers that Amplifies their Skillset”

American Society for Engineering Education (ASEE) Mid-Atlantic Fall Conference (10/17)

- Presented paper on assessing student engagement using video recordings

University Economic Development Association (UEDA) 2017 Summit (10/17)

- Presented as part of 3-member panel on: Entrepreneurial Mindset Development: What it is and why it is important?

Lehigh Center for Innovation in Teaching and Learning Symposium (4/17)

- Presented on technologies to flip classroom and use Google Products Suite to increase student engagement in lectures and simplify feedback

Lehigh KEEN ICE Workshop (1/17)

- Helped lead a workshop to introduce entrepreneurial minded learning (EML) to 20 members of KEEN cohort 2 at Lehigh University

KEEN 2017 Winter Conference, Jacksonville, FL (1/17)

- Shared PreLUision module developed for incoming women engineers

KEEN 2016 Winter Conference, Tempe, AZ (1/16)

- Exhibited EML redesign of ME 207 Dynamics Lab
- Attended sessions on T-Shaped Systems Thinking, Engineering Grand Challenges, and Amplifying KEEN

Innovating Curriculum with Entrepreneurial Mindset (ICE), Lawrence Tech., (6/15)

- Week-long deep dive on instilling Entrepreneurial Mindset into students using Active and Collaborative Learning (ACL), Problem/Project Based Learning (PBL), and Entrepreneurial Minded Learning (EML)

Publications

A Search-based Configuration and Motion Planning for a Snake-like Drilling Robot

- In-progress (Spring, 19)
- Authors: Xiaolong Wang, Matthew Bilsky, Subhrajit Bhattacharya

US Provisional Patent – US62/692,680 (06/18)

- Snake-like robot improvements

A Preliminary Investigation into the Use of Audience Video Recordings to Assess Student Engagement During Large Lecture Classes (10/17)

- Co-authored by 3 students: Christian Davis, Kiana Wright, and Kumar Swagat
- Fall 2017 Mid-Atlantic ASEE Conference, October 6-7 – Penn State Berks

US Provisional Patent – US62/527,597 (06/17)

- Snake-like robot improvements

Patent Cooperation Treaty (PCT) – PCT/US2016/55791 (10/16)

- International patent protection filing for two prior provisional patents
- International Search Authority Report and Written Opinion identified only 4 “A” references indicating device is state of the art and all 31 claims are patentable

US Provisional Patent – US62/278,487 (1/16)

- Three-dimensional cycloidal eccentric drive with self-locking and unlocking mechanism

US Provisional Patent – US62/237,987 (10/15)

- Snake-like robot including rigid links that can lock, rotate, and extend.
- Cycloid drive innovations
- Flexible drive shaft through hollow snake-like robot

Academic and Recreational Inventions/Projects

SnoTunes (12/14)

- Text message enabled, 160 Watt stereo in a backpack with 8+ hours of battery life
- Users can text message YouTube links to songs and song skip requests to dedicated number creating a collaborative listening experience.
- Selected as case study in the use of NEXMO API for Internet of Things projects
- Featured project on HackADay.com
- 10-day term break rapid prototyping project

Hotkey Grading Device (1/14)

- Plug-in USB input device that expedites entering student for grades for ENGR 10/97
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Dry-O-Matic (summer, 2013)

- Text message based notification system that alerts when clothes dryer is finished

Forward and inverse dynamic simulation of a 3 DOF robot arm (spring, 2013)

- Calculated forward and inverse kinematics, inertias, and dynamics to determine and simulate requisite torques to drive a robotic arm
- Only student in graduate class to get their Simulink simulation to work

SmartRx (fall, 2012)

- Designed and constructed a functioning prototype of a smart pill loading and dispensing system with accompanying Android applications
- Presentation video used as demonstration in future graduate Integrated Product Development lectures

Flight Data System (spring/fall, 2011)

- Senior Project/IPD Capstone: Designed and prototyped a Flight Data System for model aircraft to relay real-time flight telemetry and aid in locating crashed aircraft

Text message lock and doorbell (fall, 2010)

- Constructed a door lock and access control system that can unlock, lock and notify of doorbell rings by text message as 2nd project in Smart Product Development course

Thermal Chamber (fall, 2010)

- Designed, wired, and documented a miniature incubator chamber in a recycled ATX power supply case
- Used as model experiment for both freshman programming and mechatronics course curriculums

Interactive Illuminated Sculpture (fall, 2009)

- Created sculpture that glowed brighter as more viewers touched it to convey the emotion of connection using self-built multi-touch and an early generation Arduino for 3D Design course

Activities/Hobbies

- Skied an average of 60 days per season while in graduate school
- Mountain biking, kayaking, camping, ski racing, white water rafting, woodworking, hobby prototyping/making

Professional Societies

- American Society of Mechanical Engineers

Licenses/Certifications

- Pennsylvania Home Improvement Contractor – PA109920 (7/14-Present)
- Professional Engineer – PE086963 (12/17-Present)
- Engineer in Training, PA Bureau of Prof. and Occupational Affairs (12/12-12/17)
- Emergency Medical Technician, PA Department of Health (12/09-Present)
- Swift Water Rescue (6/09-Present)