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### **Education – Lehigh University, Bethlehem, Pa**

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**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)

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### **Doctoral Work**

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**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
- 2<sup>nd</sup> place in 2016 Lemelson-MIT Student Inventor Competition

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### **Awards/Honors**

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**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 (2<sup>nd</sup> 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)

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## Grants

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### **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 – 1<sup>st</sup> 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

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## **Teaching Experience**

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### **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-Present)**

- 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-Present)**

- 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 thermal chamber design and 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

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## **Employment History**

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### **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-Present)
- 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

**5<sup>th</sup> 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

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**Research Experience at Lehigh University**

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**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

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**Conferences and Presentations**

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**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)

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## **Publications**

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### **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
- 500+ pages of dissertation

### **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

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## **Academic and Recreational Inventions/Projects**

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### **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 2<sup>nd</sup> 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

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**Activities/Hobbies**

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- 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

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**Professional Societies**

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- American Society of Mechanical Engineers

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**Licenses/Certifications**

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- 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)