Ji Chen

SUMMARY:

PhD in biomedical engineering with a focus on wearable robotics and control. Expertise in design, manufacturing, and clinical evaluation of rehabilitative exoskeleton and robotic devices. Expertise in electronic control systems, mechatronics systems, bio-mechanics modelling, bio-mechanics analysis, and gamification.

SELECTED RESEARCH/ENGINEERING EXPERIENCE

Jan 2020 – May 2020 **Visiting Assistant Professor**

Center for Biomechanical & Rehabilitation Engineering (CBRE), University of District Columbia, Washington, DC

- Develop home and community based gait training protocol using assistive technology. Design and evaluate active and passive orthosis.
- Investigate differences in standing balance for young, healthy individuals from both athlete and non-athlete subject populations through ground reaction force and center of pressure parameters.
- Investigate a new Generation of Assistive, Innovative Technologies (GAIT) for balance rehabilitation.
- Examine the attitudinal effects of Biomedical Engineering Activities and female engineering role-model exposure on under-presented minority female youths and young adults towards their perceptions of engineering.

April 2017– Dec 2019 **Intramural Research Training Award (IRTA) Postdoc Fellow**

Functional & Applied Biomechanics Section National Institutes of Health (NIH), Bethesda, MD

- Served as the **technical leader** of NIH exoskeleton robot project team; supervised 4 IRTA post baccalaureate trainees and 2 NIH Biomedical Science Enrichment Program (BISEP) summer interns in designing control hardware and software and implementing wireless communications, as well as in controller simulation and evaluation. Team awarded **2018 NIH Director Award**. Project served as the pioneering study worldwide for using a robotic exoskeleton to treat abnormal crouch gait, for which there are currently no effective long-term solutions to treat.
- Developed exoskeleton robot and rehabilitation protocol to treat crouch gait of children with cerebral palsy (CP). The robot was implemented with three control strategies (adaptive, impedance, and constant torque). The in-lab training study on children with crouch gait using this robot in the NIH IRB training protocol aims to identify which control strategy maximizes the benefit of training in terms of clinical outcome measures and biomechanics for each participant.
- Develop a Python-based graphic user interface for tele-rehabilitation, and supervise intern for this project.
- Earned **NIH Mentoring Award with the Amgen Scholars Program** to design 2 passive exoskeletons for knee rehabilitation; supervised and mentored intern for this project
- Developed a biological knee joint moment estimation method during walking.
- Collaborated with two research groups to develop light-weight robotic exoskeletons for gait training of adult population.

Aug 2012 – Jan 2017 **Researcher Assistant**

The Catholic University of America & Medstar National Rehabilitation Hospital, Washington, DC

- Developed a game therapy using microprocessor-based mouse control function in a Hand Exoskeleton Rehabilitation Robot (HEXORR). Implemented a training protocol that used the HEXORR with a repertoire of games to treat impaired hand function of 8 chronic stroke individuals for 12 visits, lasting 90 minutes. Used the HEXORR and an electromagnetic motion capture system the MiniBirds (Ascension Technologies) controlled by Motion Monitor Software (Innovative Sports Technology) to clinically assess the hand/arm function.
- Clinically evaluated the spring-operated hand device (HandSOME) for treating hand/arm function in 10 chronic stroke individuals through a 4-week long home study. Remodeled

an ARMin III exoskeleton robot design for arm rehabilitation to reduce movement inertia using SolidWorks.
- Supervised 3 international visiting students from Brazil (2015-2016) to design an exoskeleton for arm rehabilitation and a finger position acquisition system using inertial measurement unit sensors. Mentored 2 college students in examining potentials of upper extremity exoskeleton SpringWear on recovering stroke patients.

May 2008 – April 2010 **Research Assistant**

Temple University, Philadelphia, PA

- Developed a system (including a linear motion rail, a LabView based data collection interface, a simple visual reality interface, and a 2D planar motion analysis system) to study human head stabilization strategies during linear and/or visual perturbations.
- Results provided implications for virtual rehabilitation: initial study on 12 healthy adults concludes that head stabilization shows visual and inertial dependence during passive stimulation.

Sept 2003 – Dec 2006 **Assistant Engineer**

Applied Electromagnetism Group, Institute of Applied Electronics, Mian Yang, China

- Collaborated on design of an airborne telecom component testing system suspended from an unmanned helicopter.
- Designed and constructed a testing platform to hold antenna system for electronic compatibility test.
- Implemented AutoCAD drawings and fabrication for gas switch and wave-guide transmission lines to achieve higher power in the research of pulse compression.

EDUCATION

Aug 2012 – Jan 2017 **PhD in Biomedical Engineering**

The Catholic University of America, Washington, DC

Dissertation title: Spring-Operated Wearable Enhancer for Arm Rehabilitation (SpringWear).
Developed 5-degrees-of-freedom arm exoskeleton from the concept to prototype to assist upper limb joint movement for stroke survivors, merging user comfort, safety, reliability and efficiency. Disseminated results in presentations and publications.

Sept 2011 – May 2012 **PhD program in Mechanical Engineering**

Temple University, Philadelphia, PA

Course project: modeling inverse cockroach locomotion with 'tripod' gait pattern.
Project aimed at understanding the mechanism of inverted cockroach running (on the ceiling) by constructing mathematical models. Proposed a spring-mass model by analyzing the center of mass data of cockroaches.

Sept 2007 - May 2010 **MS in Mechanical Engineering**

Temple University, Philadelphia, PA

Thesis title: Design and Usability of a System for the Study of Head Orientation.
A laboratory environment was developed for virtual reality study on head control during seated locomotion from concept to prototype.

Sept 1999 – July 2003 **B.S., Machine Design, Manufacturing and Automation**

University of Electronic Science and Technology of China, Chengdu, China

Senior design project: Overhaul a hydraulic bench including gear-motor transmission, power actuation including pistons and valve fitting, sensor system using AutoCAD and Protel DXP.

TEACHING/MENTORING EXPERIENCE

Jan 2020 – May 2020 **Visiting Assistant Professor**

University of District of Columbia, Washington, DC

- Teach BMEG Technical Elective course to ME and BME senior students. Students learn how to design a simple rehabilitation device and conduct biomechanics analysis for device evaluation.

Jan 2016 – May 2016
Sept 2013 – Dec 2013
The Catholic University of America, Washington, DC

Teaching Assistant

- Assisted teaching BE202 Biomechanics and BE315 Introduction to Biomedical Systems Analysis. Taught labs for 2 sections of ENGR503 Control Systems. Demonstrated and explained the influence of the proportional, integral and derivative terms in a PID feedback controller on the dynamic behavior of a 2nd order mass-spring-dashpot system.

Sept 2011 – July 2012
Temple University, Philadelphia, PA

Graduate Academic Intern-Tutor

- Tutored students on concepts and course content; developed customized methods to help students overcome difficulties in understanding. Subjects included math (up to Calculus III) and physics (up to Physics II). 20 hours per week in classroom environment.

Jan 2011 – May 2011
Charter School Services, LLC, Philadelphia, PA

Substitute Teacher

- Developed and taught lesson plans to a class of 24 students, ranging from 1st grade to 8th grade.

Sept 2007 – May 2008
Sept 2009 – Dec 2009
Temple University, Philadelphia, PA

Teaching Assistant

- Designed lab class for Introduction to Experimental Design. Helped students understand how to use data acquisition system from National Instruments, LabView software, and sensors to achieve synchronized data collection and pre-processing for an application-oriented experiment.

Jan 2007 – July 2007
Mian Yang College of Radio and Television, Mian Yang, China

Lecturer

- Presented on Fundamentals of Hydraulic and Pneumatic Engineering.

VOLUNTEERING EXPERIENCE

Jan 2020– Present
Rehabilitation Medicine Department, National Institutes of Health (NIH), Bethesda, MD

Special Volunteer

- Collaborate on mechanical, embedded electronic, and control system design of a novel robotic exoskeleton device.
- Involve in data collection during its device use for its validation and evaluation in the Functional & Applied Biomechanics Section of the Rehabilitation Medicine Department.
- Contribute to data analysis, interpretation, and reporting via assistance in manuscript preparation.

Mar 2019– Present
National Institutes of Health (NIH), Bethesda, MD

Research Volunteer

- Served as a health subject in NIH clinical studies

Jan 2013 – Dec 2016
National Rehabilitation Hospital (NRH), Washington, DC

Research Volunteer

- Coordinated stroke survivors' therapeutic training in robotics using hand robot HEXORR.
- Performed arm/hand biomechanics evaluation using Motion Monitor software and 6-degree Ascension Flock of Birds trackers. Participated in home study using accelerometers to track the arm movement of chronic stroke individuals.
- Trained 2 NRH engineers to use the system.

Aug 2010 – May 2011
Retired Scientists, Engineers & Technicians (ReSET), Washington, DC

Science Volunteer

- Presented science experiments for elementary age children in DC Public Schools.

FELLOWSHIP AND HONORS

Apr 2017- Dec 2019	**Intramural Postdoctoral Research Training Award,** National Institutes of Health, Bethesda, MD
Oct 2019	**1st place poster for 2019 Clinical Center Research Retreat,** National Institutes of Health, Bethesda, MD
Sept 2019	**Selected to present at 2019 NIH Research Festival on September 11,** National Institutes of Health, Bethesda, MD
Aug 2019	**The Fellows Award for Research Excellence (FARE) 2020 competition,** National Institutes of Heal Bethesda, MD
Aug 2018	**NIH Director Award,** National Institutes of Health, Bethesda, MD
Aug 2018	**Best Paper Award Finalist,** BIOROB 2018, Enschede, The Netherlands
Feb 2018	**NIH Mentoring Award/AMGEN Scholars Program,** National Institutes of Health, Bethesda, MD
Sept 2012 – Aug 2015	**Millennium Fellowship,** The Catholic University of America, Washington, DC
Jan 2016 – Dec 2016	**1st Place, 2016 Dissertation/Thesis Research Grant**, The Catholic University of America, Washington, DC
Mar 2016	**Highest Score Abstract, Orthopedics/Sports Medicine/Neuro-Rehab,** 2016 MedStar Health Research Symposium, Columbia, MD

SELECTED PUBLICATIONS

1. **J. Chen**, J. Hochstein, C. Kim, L. Hammel, C. Stanley, D. L. Damiano, and T. C. Bulea , "Toward a Wearable Pediatric Robotic Knee Exoskeleton for Overground Gait Rehabilitation in Ambulatory Individuals", *IEEE/ASME Transactions on Mechatronics* (under revision).
2. **J. Chen**, L. Tucker, L. Hammel, A. Gravunder, D. L. Damiano, and T. C. Bulea , "Development of a User Interface for Wearable Technology.", *Journal of Rehabilitation and Assistive Technologies Engineering, SAGE journals* (submitted).
3. **J. Chen**, W.G Wright, K. Darvish, "Design and Usability of a System for the Study of Head Orientation", *Journal of Biomechanics* (submitting).
4. **J. Chen**, I. Munoz, D. L. Damiano, and T. C. Bulea , "Development and Characterization of Spring Loaded Knee Brace for Reducing Crouch Gait in Children with Cerebral Palsy.", *Rehabilitation Engineering & Assistive Technology Society of North America (RESNA) Assistive Technology journal* (submitting).
5. **J. Chen**, T. Chen, R. Casas, M. Sandison and P. S. Lum, "Hand Function Recovery in Chronic Stroke with HEXORR robotic training." (In preparation).
6. J. Hochstein**, J. Chen**, C. Kim, D. L. Damiano, and T. C. Bulea, "Development of Control Strategies for a Portable Robotic Exoskeleton." (In preparation).
7. C. Kim**, J. Chen**, J. Hochstein, D. L. Damiano, and T. C. Bulea, "Development of Electronic Hardware for a Portable Robotic Exoskeleton." (In preparation).
8. B. Shideler, **J. Chen,** A. Gravunder, C. J. Stanley, D. L. Damiano, and T. C. Bulea, "A pediatric robotic exoskeleton (P.REX) that provides synchronized knee extension assistance and functional electrical stimulation for children with crouch gait." (In preparation)
9. **J. Chen**, D. L. Damiano, Z. F. Lerner and T. C. Bulea "Validating model-based prediction of biological knee moment during walking with an exoskeleton in crouch gait: potential application for exoskeleton contro**l**", *The 16th International Conference on rehabilitation robotics, Toronto,* Canada, 2019.
10. I. Almubark, L. C. Chang, R. Holley, I. Black, E. Chan, **J. Chen**, A. Dromerick, and P. Lum. "Machine Learning Approaches to Predict Functional Upper Extremity Use in Individuals with Stroke", *Conf Proc IEEE Big Data,* vol. 2018, Dec 2018.
11. **J. Chen**, J. Hochstein, C. Kim, D. Damiano, and T. Bulea "Design Advancements toward a Wearable Pediatric Robotic Knee Exoskeleton for Overground Gait Rehabilitation", *The 7th IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics, Enschede*, Netherlands, 2018
12. **Chen, J.,** Lum, S.P. (2017) "Pilot Testing of the Spring Operated Wearable Enhancer for Arm Rehabilitation", *Journal of NeuroEngineering and Rehabilitation.*
13. **Chen, J.**, Nicols D., Brokaw, B. E. Lum, S. P. (2017) "Home-based Therapy after Stroke Using the Hand Spring Operated Movement Enhancer (HandSOME)", *IEEE Transactions on Neural Systems and Rehabilitation Engineering,* TNSRE.2017.2695379.
14. **Chen, J.,** Lum, S.P. (2016) "Spring Operated Wearable Enhancer for Arm Rehabilitation (SpringWear) after Stroke", *38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Orlando*, FL, 2016.

REFERENCES

Thomas Bulea, PhD	Postdoc Mentor
Diane Damiano, PhD	Postdoc Mentor
Barbara Houtz	Pedagogy Mentor
Peter Lum, PhD	PhD adviser
Kurosh Darvish, PhD	Master’s thesis adviser