Zhongqing Han

Software Engineer · Simulation Research Engineer

2433 22nd ST Apt 6, Troy NY 12180

(+1) 518-596-9306 | hzqingcool2012@gmail.com | hzGitHub.github.io | zhongqing-han

Education

Rensselaer Polytechnic Institute (RPI), Center for Modeling, Simulation, and Imaging in Medicine (CeMSIM) — *Troy, NY*

Ph.D. in Mechanical Engineering, supervised by Prof. Suvranu De. GPA 3.95/4.0 — *Expected, Jul. 2018*

- THESIS: Real-time simulation of Electrosurgical procedures

University of Science and Technology of China (USTC) — *China*

M.S. in Mechanical Engineering — *Jun. 2012*

University of Science and Technology of China — *China*

B.S. in Mechanical Engineering — *Jun. 2009*

Projects

Characterization of mechanics of electrosurgical cutting for liver tissue — *Troy, NY*

Research Assistant at CeMSIM — *Dec. 2017 - present*

- Performing ex vivo tissue experiments to determine fracture toughness of liver tissue
- Developing an inverse optimization model to characterize the mechanics of electrosurgical cutting

Reduced Order Modeling for Electrosurgery — *Troy, NY*

Research Assistant at CeMSIM — *Nov. 2017 - present*

- Developing proper generalized decomposition (PGD) based reduced order model for large scale multiphysics simulation in electrosurgery
- Building a RNN using tensorflow for analysis on the evolution of reduced basis

Multi-physics Model for Electrosurgical Cutting of Soft Tissue — *Troy, NY*

Research Assistant at CeMSIM — *Jul. 2016 - Oct. 2017*

- Developed deflation based block preconditioner for solving large scale multi-physics problem that resulted in linear increase in computational cost with increase in number of degrees of freedom
- Proposed cellular level micromechanical model to describe thermo-mechanical response of soft tissue
- Developed level set method to tissue fracture driven by second law of thermodynamics

Electromagnetic Simulations (Current Pathway) on AustinMan Voxel Model — *Troy, NY & Boston, MA & Carrboro, NC*

Research Assistant at CeMSIM & Allied Health Professional Member at Carl J. Shapiro Simulation & Skills Center & Long-term Visitor at Kitware — *Sep. 2015 - Jun. 2016*

- Developed an immersive and interactive GUI (QT, VTK) in zspace, later tansfered to HTC Vive with Leap Motion
- Demonstrated current flow through virtual human based on Maxwell's equations and how dispersive electrode protects the patient
- Designed several clinically relevant abnormal scenarios due to any abnormal associated conditions (excessive body hair, previous scarring, implants)
- Performed pilot study at Carl J. Shapiro Simulation & Skills Center and face validation at SAGES learning center

Development of the Virtual Electrosurgery Skill Trainer (VEST) for Monopolar Electrosurgical Tasks — *Troy, NY & Boston, MA*

Research Assistant at CeMSIM — *Jan. 2014 - Jun. 2015*

- Developed the monopolar electrosurgery interactions that include cutting, coagulation and fulguration in VEST
- Controlled the power settings and modes of operation by a virtual electrosurgical unit

Physics-based Real Time Computational Technology for Electrosurgical Procedures. *Troy, NY*

Research Assistant at CeMSIM *Jan. 2013 - Nov. 2013*

- Presented a real-time and physically realistic simulation of electrosurgery, by modeling the electrical, thermal and mechanical properties as three iteratively solved finite element models
- Proposed a dynamic triangulation algorithm based on isotherms to provide sub-finite element graphical rendering of vaporized tissue
- Utilized block compressed row storage (BCRS) structure for computationally efficient changes in the tissue topology
- Transitioned the techniques to a virtual laparoscopic adjustable gastric banding (LAGB) surgical simulator

Experience

Professional Experience

- Visiting Allied Health for **SAGES** (Society of American Gastrointestinal and Endoscopic Surgeons) 2017 Annual Meeting, Houston, Texas, March 2017
- Faculty of Workshop - VEST at the 9th Annual **ACS-AEI** (Division of Education of the American College of Surgeons and the Program for Accreditation of Education Institutes) Postgraduate Course, Carl J. Shapiro Simulation & Skills Center, Beth Israel Deaconess Medical Center, Boston, Massachusetts, September 2016
- Visiting Allied Health for **SAGES** (Society of American Gastrointestinal and Endoscopic Surgeons) 2016 Annual Meeting, Boston, Massachusetts, March 2016
- Long-term visitor at **Kitware**, Carrboro North Carolina, May 2016 - Present
- **IDEAS** (Innovation, Design and Emerging Alliances in Surgery: Virtual Surgery) workshop, Carl J. Shapiro Simulation & Skills Center, Beth Israel Deaconess Medical Center, Boston, Massachusetts, November 2013

Teaching Experience

- Teaching assistant for the undergraduate Vibrations class, Aug. 2014 - Dec. 2014
- Teaching assistant for the undergraduate Introduction to Manufacturing Planning class, Jan. 2013 - May 2013
- Teaching assistant for the undergraduate Introduction to Engineering Analysis class, Aug. 2012 - Dec. 2012

Publications

Journals

- **Z. Han**, Rahul, and S. De, PGD acceleration of coupled problems in electrosurgery, prepared for *Comput. Methods Appl. Mech. Engrg.*, 2018
- M. Dombek, C. A. López, **Z. Han**, D. B. Jones, J. Olasky, S. Schwaitzberg, C. Cao, S. De, FUSE certification enhances performance on an immersive virtual reality based simulator for dispersive electrode placement, accepted by *Surgical Endoscopy*, 2018
- **Z. Han**, Rahul, and S. De, A multiphysics model for radiofrequency activation of soft hydrated tissues, submitted to *Comput. Methods Appl. Mech. Engrg.*, 2017
- Z. Lu, V. S. Arikatla, **Z. Han**, B. F. Allen, and S. De, A physics-based algorithm for real-time simulation of electrosurgery precedures in minimally invasive surgery, *Int. J. Med. Robot.*, 10(2014), 495-504
- L. Sun, J. Wand, **Z. Han**, and C. Zhu, Active Vibration Suppression Based on Intelligent Control for a Long-range Ultra-precise Positioning System, *Applied Mechanics and Materials*, 87(2011), 123-128

Proceedings

- **Z. Han**, Rahul and S. De, An efficient solution approach for multiphysics modeling of electrosurgery, *13rd World Congress on Computational Congress (WCCM 2018)*, 2018
- **Z. Han**, Rahul, C. A. López, and S. De, A fast Krylov subspace-based method for multi-physics modeling of electrosurgical cutting of soft tissue, *VII International Conference on Coupled Problems in Science and Engineering*, Invited Sessions, 2017
- M. Dombek, C. A. López, **Z. Han**, D. B. Jones, J. Olasky, S. Schwaitzberg, C. Cao, S. De, The virtual electrosurgical skill trainer (VEST)-Face validation of a dispersive electrode placement module, Poster presentation at SAGES 2017 Annual Meeting; 2017 Mar. 22-25; Houston, TX.
- M. Dombek, C. A. López, **Z. Han**, D. B. Jones, J. Olasky, S. Schwaitzberg, C. Cao, S. De, The virtual electrosurgical skill trainer (VEST)-Principles of current pathway, Poster presentation at SAGES 2016 Annual Meeting; 2016 Mar. 16-19; Boston, MA.
- **Z. Han**, V. S. Arikatla, and S. De, A local level set-based approach for modeling electrosurgical tissue cutting, *13rd National Congress on Computational Mechanics*, Minisymposia, 2015
- **Z. Han**, V. S. Arikatla, and S. De, GPU-based parallel algorithms for simulation of Electrosurgery procedures in real-time, *13rd National Congress on Computational Mechanics*, Minisymposia, 2015
- X. Chen, S. Yang, and **Z. Han**, etc., Real-time, 3-dimensional scanning imaging system using tunable lens for dynamic precess, *Intelligent computation and Bio-Medical Instrumentation (ICBMI), International conference on IEEE*, 2012

Professional Skills

1. **Operating Systems**, Windows, Linux
2. **Programming**, C++/C, Matlab, Python, CUDA, WebGL, QT, VTK
3. **Game Engines**, Unity, Unreal