

Zhongqing Han

SOFTWARE ENGINEER · SIMULATION RESEARCH ENGINEER

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“Change before you have to.”

Education

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

Troy, U.S.A.

PH.D. IN MECHANICAL, AEROSPACE, AND NUCLEAR ENGINEERING, SUPERVISED BY PROF. SUVRANU DE

Aug. 2012 - PRESENT

- THESIS: Real-time simulation of Electrosurgical procedures.

USTC(University of Science and Technology of China)

Hefei, China

M.S. IN MECHANICAL ENGINEERING

Sep. 2009 - Jun. 2012

- THESIS: Real-time three dimensional shape measurement.

USTC(University of Science and Technology of China)

Hefei, China

B.S. IN MEASUREMENT AND CONTROL

Sep. 2005 - Jun. 2009

- Research and development of data transmission and storage module on HOLTER system.

Projects

Multi-physics Model for Electrosurgical Cutting of Soft Tissue

Sep. 2014 - present

- Developed fast multigrid algorithm for solving large scale multi-physics problem.
- Proposed cellular level micromechanical model to describe thermo-mechanical response of tissue.
- Developed level set method to tissue failure driven by second law of thermodynamics.

Electromagnetic Simulations (Current Pathway) on AustinMan Voxel Model (Module 4)

Sep. 2015 - Jun. 2016

- Developed an immersive and interactive GUI (QT, VTK) in zspace, later transferred to HTC Vive.
- 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).

Development of the Virtual Electrosurgery Skill Trainer (VEST) for Monopolar Electrosurgical Tasks (Module 1).

Dec. 2013 - Jun. 2014

- 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 running on an iPad2.

Physics-based Real Time Computational Technology for Electrosurgical Procedures.

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.

Industrial 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

Publications

Journals

- **Z. Han**, Rahul, and S. De, Multigrid acceleration of coupled problems in electrosurgery, submitted to *Comput. Methods Appl. Mech. Engrg.*, 2017
- M. Dombek, C. A. López, **Z. Han**, etc., Face validation of a dispersive electrode placement Virtual Electrosurgical Skill Trainer (VEST) module, submitted to *Surgical Endoscopy*, 2017
- **Z. Han**, Rahul, C. A. López, and S. De, A multi-physics model for electrosurgical cutting of soft tissue, 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 procedures 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, 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
- **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 (ICBIM)*, *International conference on IEEE*, 2012

Professional Skills

- 1 **Operating Systems**, Windows(proficient), Linux(proficient)
- 2 **Programming**, C++/C(proficient), Matlab(proficient), Python(intermediate), GLSL(intermediate), CUDA(intermediate), WebGL(intermediate), QT(intermediate), VTK(proficient)
- 3 **Game Engines**, Unity(intermediate), Unreal(intermediate)