Jui-Hsien Wang

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Education

Ph.D., Computational and Mathematical Engineering, Stanford University, 2015 – 2019 (expected).

M.S., Mechanical Engineering, Cornell University, 2013 – 2015.

M.S., Engineering Physics, University of California, San Diego, 2011 – 2013.

B.S., Mechanical Engineering, National Taiwan University, 2005 – 2009.

Research Interests

Computer Graphics

Physics-based Simulation

High-performance Computing

Machine Learning

Publications

[1] **Jui-Hsien Wang**, and Doug L. James. 2019. KleinPAT: Optimal Mode Conflation For Time-Domain Precomputation Of Acoustic Transfer. *ACM Trans. Graph. (SIGGRAPH 2019)* 38, 4, Article 122 (July 2019).

[2] **Jui-Hsien Wang**, Ante Qu, Timothy R. Langlois, and Doug L. James. 2018. Toward Wave-based Sound Synthesis for Computer Animation. *ACM Trans. Graph. (SIGGRAPH 2018)* 37, 4, Article 109 (August 2018).

[3] **Jui-Hsien Wang**, Rajsekhar Setaluri, Doug L. James, and Dinesh K. Pai. 2017. Bounce Maps: An Improved Restitution Model for Real-Time Rigid-Body Impact. *ACM Trans. Graph. (SIGGRAPH 2017)* 36, 4, Article 150 (July 2017).

[4] **Jui-Hsien Wang**, and Juan Carlos del Álamo, Mechano-Chemical Model of Cancer Cell Invasion. *Master Thesis*, 2013.

[5] **Jui-Hsien Wang**, Wu-Cheng Chi, R. Nigel Edwards, and Eleanor C. Willoughby. Effects of Sea States on Seafloor Compliance Studies, *Marine Geophysical Research*, 31(1): 99-107, 2010.

Research Experiences

NVIDIA Research (Research Intern)
Santa Clara, CA – 2019 Summer

- I am working in the New Experience Group (NXP) with Ward Lopes. Morgan McGuire is my manager.

Adobe Research (Research Intern)
Seattle, WA – 2017 Summer

- I collaborated with Tim Langlois at Adobe on developing several key components used in our general-purpose sound rendering system paper at SIGGRAPH 2018.
  - ◇ Impact: I developed an algorithm to smoothly interpolate the pressure fields when objects pass through simulation domain boundaries – key to handle dynamic scenes.
  - ◇ Impact: We developed the water bubble shader that produces much better fluid sounds[1] and ran 10x faster compared to the previous approaches.

Disney Research (Research Intern)
Boston, MA – 2015 Summer

[1] https://youtu.be/5I8KCTuDBek?t=9

- At Disney Research, I worked with David Levin and the computational fabrication group at MIT to develop algorithms and design tools that enable efficient instrument/muffler design. I researched and developed a novel impedance-based forward propagation model that enables fast acoustic wave computation for 3D-printed mechanical structures.
  - ◇ Impact: I implemented the impedance-based model in C++ and it runs in real-time compared to several minutes for a full wave simulation and has high accuracy.
  - ◇ Hands-on experience with state-of-the-art 3D printers.
  - ◇ Found a way to use and test CodeAster, a C++ FEM software whose documentation and command line outputs are all in French, without knowing French.

Stanford/Cornell University (Graduate Student Researcher)
Stanford, CA & Ithaca, NY – 2013 to 2019

- I started as a Ph.D. student at Cornell and reapplied to be at Stanford after my adviser, Doug James, made the switch in my second year. I worked on a number of graphics/simulation/computing projects over the years and made major contributions in sound synthesis and physics-based animation. I passed the Ph.D. qualification exams *twice* at two different institutions!
- **Bounce Maps**: Most if not all current rigid-body simulators assume the elastic response of an impacted object is determined by a single, global constant called the restitution coefficient. We showed in our SIGGRAPH paper that this assumption is seriously wrong – it is a highly oscillatory function that depends on both impact positions and normals.
  - ◇ Impact: We developed a precomputation algorithm to compute millions of Bounce Maps samples in minutes in C++; the map can be queried in a real-time texture lookup.
- **Next-Generation Wavesolver**: In this project, we developed the first general-purpose, high-quality, render-everything-you-ever-heard sound rendering system, analogous to the early days Reyes rendering architecture for images. From the ground up (problem formulation), we architected an end-to-end system and built supporting infrastructure that can render realistic physics-based sounds. The system was developed in C++, and received a wide attention from the community as well as the press.
  - ◇ Impact: I built the first end-to-end sound rendering system that can generate realistic sounds made by rigid bodies, thin shells, water, characters, . . . anything that vibrates.
  - ◇ Impact: We developed a new parallel-in-time algorithm that can linearly scale the rendering up to hundreds of cores on the cloud to handle complex scenes.
- **KleinPAT**: Precomputed Acoustic Transfer (PAT) makes real-time modal sound model sounds great. However, traditional PAT relies on per-mode Helmholtz BEM solver, which can take several days for an object with a few hundred modes. This makes it impractical for many applications.
  - ◇ Impact: We introduced KleinPAT, a novel conflate-simulate-deconflate GPU solver that is more than 4000 times faster compared to state-of-the-art methods for computing acoustic transfer.

University of California, San Diego (Graduate Student Researcher)
San Diego, CA – 2011 to 2013

- I did an optional master thesis on the mechanics of metastatic cancer cells. Using analytical and numerical tools, I studied how a nonlinear substrate (such as the extracellular matrices) can be affected both mechanically and chemically by migrating cancer cells (which typically secrete enzymes to make the substrate softer locally, for example).
  - ◇ Impact: I developed a novel mechano-chemical model that can be used to study the stability and dynamics of the phenomenon; it was published as a master thesis.
  - ◇ Hands-on experience and tools: perturbation analysis, nonlinear elastostatics, stiff systems (reaction-diffusion equation).

Institute of Earth Sciences, Academia Sinica (Undergraduate Student Researcher)
Taipei, Taiwan – 2008 to 2010

- I spent a lot of time in my undergrad working in marine oceanography and seismology. In particular, we deployed oceanbottom seismic sensors in the Pacific Ocean in order to estimate methane hydrates by estimating the shear modulus in marine sediments.
  - ◇ Impact: I analyzed data from a 10-month experiment and observed metrics that give rise to higher quality data, and published in a well-established journal.

Teaching Experiences

Teaching Assistant: Stanford University, Computer Graphics: Animation and Simulation, 2016.

Teaching Assistant: Cornell University, Intermediate Fluid Dynamics with CFD, 2014.

Graduate TA Trainer: Cornell University (School of Engineering), 2014-2015.
- Teach classes in School of Engineering orientations for all incoming TAs.

Teaching Assistant: University of California, San Diego, Multiple courses, 2011-2013.
- Computational Methods in Engineering.
- Advanced Fluid Mechanics.
- Aerodynamics.
- Fundamentals of Propulsion.
- Probability and Statistical Methods.

Scholarships and Awards

SIGGRAPH 2019 Invited Poster, 2019

Adobe Research Fellowship Finalist, 2018.

Adobe Research Fellowship Finalist, 2015.

NVIDIA Graduate Fellowship Finalist, Nvidia 2015.

Harriet Davis Graduate Fellowship, Cornell University 2013-2014.

Best Teaching Assistant Award, University of California San Diego, 2013.

Skills

Programming	C, C++, CUDA, Java
Scripting	Python, Matlab
Machine Learning	Tensorflow, Keras, scikit-learn
Misc.	Google Cloud Compute Platform, Vim (and vim only), LaTeX

Other Academic Presentations

[6] **Jui-Hsien Wang**, Timothy Langlois, and Doug James. *Integrated All-Frequency Sound Synthesis for Physics-based Animation.* ICME Xpo Research Symposium, 2017. Poster.

[7] **Jui-Hsien Wang**, Timothy Langlois, and Doug James. *Integrated All-Frequency Sound Synthesis for Physics-based Animation.* CCRMA Open House, 2017. Poster.

[8] **Jui-Hsien Wang**, and Jane Wang. *A Simple Aerodynamic Drag-Based Model For Hovering.* Lab Technical Report, 2014.

[9] **Jui-Hsien Wang**, and Juan C. del Álamo. *Mechano-Chemical Model of Cancer Cell Invasion*, In: 14th Annual UC Systemwide Bioengineering Symposium, San Diego, CA, June 2013. Poster.

[10] **Jui-Hsien Wang**, and Juan C. del Álamo. *Mechano-Chemical Model of Cancer Cell Invasion*, In: UCSD Jacobs School of Engineering 32nd Annual Research Expo, San Diego, CA, April 2013. Poster. Honorable mention for best poster award.

[11] **Jui-Hsien Wang**, Baldomero Alonso-Latorre, Juan C. del Álamo. *Theoretical Study of Cell Invasion Through Mechano-Chemical Substrate Degradation*, In: 34th Annual International Conference of the IEEE Engineering in Medicine & Biology Society, San Diego, CA, September 2012. Poster.

Professional services

Reviewer: SIGGRAPH Asia, 2018, 2019.

Student volunteer: American Physical Society 66th Annual DFD Meeting, 2013.

Student volunteer: American Physical Society 65th Annual DFD Meeting, 2012.