Zhan ZHANG

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Research Interest

- Enhanced traditional graphics pipelines with learning-based methods
- Both Forward and Inverse Physical Simulation Problem
- Geometry Processing and Optimization-based Inverse Design for Digital Fabrication
- Learning-based Collision-free Animation Retargeting

Education

University of California, Davis Sep 2021- *Jul 2026(Expected)*
PhD, Computer Science

University of Science and Technology of China Sep 2017- Jul 2021
B.S with Honors, Applied Mathematics; B.S, Computer Science

Publications

- **Position-Based Nonlinear Gauss-Seidel for Quasistatic Hyperelasticity [link]** 2024
  Yizhou Chen, Yushan Han, Jingyu Chen, **Zhan Zhang**, Alex Mcadams, Joseph Teran
  ACM Transactions on Graphics (SIGGRPAH) 2024
  We show that a position-based, rather than constraint-based nonlinear Gauss-Seidel approach resolves issues with PBD

- **Computational Design of Flexible Planar Microstructures [link]** 2023
  Zhan Zhang, Christopher Brandt, Jean Jouve, Yue Wang, Tian Chen, Mark Pauly, Julian Panetta
  ACM Transactions on Graphics (SIGGRPAH Asia) 2023
  We develop an algorithm to accelerate homogenization and metamaterial design for nonlinear elasticity and building a complete framework for the optimal design of planar metamaterials.

- **Modeling and Fabrication with Specified Discrete Equivalence Classes [link]** 2021
  Zhong-Yuan Liu, **Zhan Zhang**, Di Zhang, Chunyang Ye, Ligang Liu, Xiao-Ming Fu
  ACM Transactions on Graphics (SIGGRPAH) 2021
  We propose a novel method to model and fabricate meshes with specified discrete equivalence classes of triangles.

- **Gaze-Contingent Retinal Speckle Suppression for Perceptually-Matched Foveated Holographic Displays [link]** 2021
  Praneeth Chakravarthula, **Zhan Zhang**, Okan Tursun, Piotr Didyk, Qi Sun, Henry Fuchs
  IEEE Transactions on Visualization and Computer Graphics (Proceedings of ISMAR) 2021
  We present the first method that reduces the "perceived speckle noise" by integrating the foveal and peripheral vision characteristics of the HVS, along with the retinal point spread function, into the phase hologram computation.

Work Experiences

Epic Games Jul 2024-
Research Intern

- Conducting research on cloth garment refitting techniques to enable robust outfit transfer across characters with varying body shapes and proportions
- Built a hybrid animation retargeting framework combining physics-based methods and GRU-based models, enabling collision-free motion transfer across characters with different body proportions; deployed as a plugin in Unreal Engine
- Designed a nonlinear Gauss-Seidel solver that improves efficiency and robustness over XPBD, implemented in Unreal Engine for rigid body, cloth, and elasticity simulations
- Explored replacing traditional decision tree architectures with large language models (LLMs) to enhance NPC behavior

Research Experiences

Computational Fabrication Lab, University of California, Davis Sep 2021-
PhD Candidate
Advisor: Prof. Julian Panetta and Prof. Joseph Teran

- Developing a machine learning–based simulation framework that leverages Transformer neural networks to efficiently generate preconditions for multigrid nonlinear solvers
- Designing computational methods for elastic metamaterials, focusing on large deformation scenarios
- Developed a hybrid animation retargeting framework that integrates physics-based methods with data-driven models, leveraging autoencoders and GRU-based networks to replicate physics solver combines inverse kinematics, props and motion semantics, and collision avoidance
- Developed a position-based nonlinear Gauss-Seidel method within multigrid solver for cloth simulation that enhances computational efficiency and numerical robustness compared to Extended Position-Based Dynamics (XPBD)
- Created the first comprehensive microstructure inverse design framework for large deformation, ensuring collision-free results and supporting both FEM- and MPM-based simulations.

Tandon School of Engineering, New York University (NYU) Jul 2020- Oct 2020
Research Intern
Advisor: Prof. Qi Sun

- Developed a method to reduce perceived speckle noise in holographic projections by accounting for the human visual system's foveal and peripheral vision characteristics in a perceptually-aware framework
- Implemented a light propagation framework using PyTorch for efficient computation and scalability

Graphics & Geometric Computing Laboratory, USTC Sep 2019- May 2020
Undergraduate Research Fellow
Advisor: Prof. Xiaoming Fu and Prof. Ligang Liu

- Developed a geometric algorithm for optimizing surface mesh equivalence fitting based on the infinite triangle distance norm
- Implemented a remeshing technique using locally equidistant embedded anisotropic surface equivalence meshes for improved geometric fidelity
- Implemented a 3D point cloud classification network using convolutional neural networks (CNNs) to enhance accuracy in spatial data interpretation

Professional Service

Reviews

- SIGGRAPH Asia
- SIGGRAPH

Teaching Experiences

University of California, Davis Sep 2021-
Teaching Assistant
Advisor: Prof. Julian Panetta and Prof. Joseph Teran

- Graded, held office hours, discussion sections, and occasionally lecture
  ECS 32A, ECS 36C, ECS 130

Awards & Scholarship

GGCS Spring Research Fellowship | UCD 2023
International Student Research Award | UCD 2021
"Outstanding Student" Scholarship | USTC 2017, 2019

Past Projects

- **MeshFEM** | ***Open-source Library Contributor*** *(microstructures repository)*
  This repository aims to provide a framework for shape optimization for various nonlinear structures, currently in particular for periodically tiled elastic microstructures.
- **CoinbaseAITrading** | ***Personal Project***
  This is a mini AI trading machine works for coinbase-api based on Convolution Transformer on Time Series.
- **MiniMeshFrame** | ***Personal Project***
  This is a mini framework for several Geometry Processing task using Discrete Differential Geometry.

Technical Skills

- **Fields of Interesting:** Digital Fabrication, Physics Simulation, Animation Retargeting, Inverse Design, Machine Learning, Geometry Processing
- **Programming:** C/C++, Python, CUDA, JavaScript, Java, HTML/CSS, LaTeX, MATLAB
- **Tools:** Git, Docker, Google Cloud Platform, Vim, Visual Studio, Houdini, Blender, Unreal Engine
- **Libraries:** Eigen, OpenCV, OpenGL, OpenMP, PyTorch, Tensorflow, Scikit-Learn