PENGYUN QIU

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EDUCATION

Nanjing University of Science and Technology **09/2018 – 06/2022**
BS in Information and Computational Science (Elite Class) | **Overall GPA:** 86.65/100 (3.6/4.0)
Honors and Awards:

- First-class Scholarship for 2021-2022 Fall Semester; Third-class Scholarship for 2020-2021 Spring Semester; Third-class Scholarship for 2020-2021 Fall Semester; Second-class Scholarship for 2019-2020 Spring Semester; Second-class Scholarship for 2019-2020 Fall Semester; Second Prize, NUST Mathematical Modeling Competition in September 2020

PUBLICATIONS

- "Modeling Wireframe Meshes with Discrete Equivalence Classes." under review by ACM Transactions on Graphics (TOG)
- "Urban Fabric Generation: A comparative analysis of multiple vector field methods." 721-730. 10.52842/conf.ecaade.2023.1.721.
- "Masonry Shell Structures with Discrete Equivalence Classes." SIGGRAPH 2023 (journal track), ACM Transactions on Graphics (TOG) 42 (2023): 1 - 12.

PROFESSIONAL EXPERIENCE

Singapore University of Technology and Design **10/2022 – present**
Research Assistant

- Conducted extensive literature reviews, analyzed academic papers and books to extract valuable insights for research. Refined and synthesized ideas from literature to develop a novel approach, validated proposed methods through rigorous experimentation, and iteratively optimized techniques based on experimental results.
- Used Rhino software to generate three models essential for assembly while ensuring the compatibility with corresponding supporters.
- Employed 3ds Max for rendering visual results, and helped print physical prototypes for demonstration.
- Lent theoretical support in aspects of geometric processing and drafted the theoretical sections of relevant paper.

Singapore University of Technology and Design (SUTD) **01/2023 – 03/2023**

- Taught over 30 junior SUTD students on computer graphics and visualization 3 hours per week.
- Graded assignments and quizzes, provided feedback and answered questions in office hours.

Shanghai Sunlight IT Consulting CO. Ltd. **03/2022 – 05/2022**
Database Development Engineer Intern

- Completed data cleaning and organization tasks, enhanced data accuracy and timeliness, maintained the corporate data platform and updated the data warehouse regularly.
- Utilized statistical methods and SQL data analysis tools to dissect complex datasets, providing valuable insights into market trends, including stock and bond markets.
- Grasped Oracle data analysis for familiarized myself with financial datasets.

RESEARCH PROJECTS

Modeling Wireframe Meshes with Discrete Equivalence Classes **02/2023 – 08/2023**
Supervisor: Professor Peng Song, Professor Ying He | Main toolkit: C++, Python, Rhino

- Studied a problem of modeling wireframe meshes where the vertices and edges respectively fall into a set of discrete equivalence classes, with the aim of fabricating large wireframe structures at lower cost and faster speed to facilitate the mass production of both nodes and rods.
- Proposed a computational approach that generated the template vertices and template edges by iteratively clustering and optimizing the mesh vertices and edges.
  - Clustered mesh vertices and edges according to their shapes and lengths. Employed two prescribed tolerances to guide the respective clustering of the vertices and edges, and gradually reduced the prescribed tolerances at each iteration to automatically discover new clusters using hierarchical clustering.

- Locally optimized the mesh to reduce the number of clusters of vertices and/or edges, and then globally optimized the mesh to reduce the intra-cluster variance for vertices and edges while ensuring the fabricability of the wireframe mesh.
- Demonstrated the effectiveness of the newfound approach on wireframe meshes with various shapes and topologies, and compared the approach with three state-of-the-art approaches to show its superiority in notable reduction in the number of distinct vertices and edges, better preservation of the shape and features of an input surface, and more automatic determination of the number of vertex classes and edge classes.
- Validated the fabricability of the results by assembling three physical prototypes with 3D-printed nodes and precision-cut wooden rods.

Urban Fabric Generation **01/2023 – 03/2023**

Supervisor: Professor F. Peter Ortner | Main toolkit: Grasshopper for Rhino

- Laid the groundwork for the Rhino/Grasshopper plugin UrbanFab, which implements vector field methods for automatically generating urban fabric geometries.
- Theorized three field design methods: distance field (D-field), boundary field (B-field) and harmonic field (H-field), with a priority on the 4-vector field.
- Put forward several methods of evaluation to visualize geometric differences relevant to urban fabric generation between the types of vector field. Established a set of mathematical-based criteria to evaluate streamline geometry: divergence, continuity, boundary perpendicularity and parallelism.
- Added a convexity metric to assess the closed polygonal tiles generated between field streamlines, and carried out singularity analysis to identify distinct breakpoints within the vector field orientation that have strong implications for urban fabric.

Masonry Shell Structures with Discrete Equivalence Classes **11/2022 – 01/2023**

Supervisor: Prof. Peng Song | Main toolkit: C++, Python, Rhino, Autodesk 3ds Max

- Developed a method to model masonry shell structures where the shell elements fall into a set of discrete equivalence classes so as to pare down the fabrication cost as well as simplify the physical construction through the reuse of certain template shell elements.
- Maximized the reusability of template elements without compromising the seamlessness and buildability of a final structure by defining three error metrics, i.e., contact error, gap error, and overlap error.
- Utilized ShapeOp to optimize geometric processing, and formulated a hierarchical cluster-and-optimize methodology to generate a small set of template elements that produce a structure closely approximating the surface with low error metrics.
- Participated in the compilation of the supplementary materials, leveraged Autodesk 3ds Max to write the scripts for 3D rendering, and modelled four physical prototypes using Rhino to validate the buildability of the end results. Displayed the feasibility of the new approach on various freeform surfaces and geometric patterns.

The Application of Radial Basis Function (RBF) in Solving Partial Differential Equations on the Sphere (Capstone) **11/2021 – 05/2022**

Supervisor: Prof. Zhengjie Sun | Main toolkit: MATLAB

- Applied the interpolation method of RBF to solve the Allen-Cahn equations on the sphere, and explored the changes in the mass and energy of the equations.
- Realized numerical algorithm for RBF-based equation solution and drew mass-change curves as well as energy-change curves.

The Fusion of Hyperspectral Imagery and Multispectral Imagery Enabled by Tensor's Manifold Structure **04/2020 – 09/2021**

Supervisor: Prof. Hongyi Liu | Main toolkit: MATLAB

- Led a team of three to fuse hyperspectral and multispectral imagery as a way of enhancing spatial and spectral resolution.
- Extracted the global features of two types of imagery using tensor's modeling patterns, and effectively conserved the local features by tapping into the complementarity of these two types of imagery.

SKILLSET

Languages: Mandarin (native), English (fluent)
Technical Skills: C++ (proficient), Python (familiar), MATLAB (proficient), SQL (proficient), Autodesk 3ds Max (familiar), Rhino (familiar), SPSS (familiar)
Core competencies: computational geometry, mathematical modeling, numerical analysis and computer-aided design