

# Xingyi Du

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## Education

### Washington University in St. Louis

PH.D. CANDIDATE IN COMPUTER SCIENCE

St. Louis, USA

Aug. 2018 - present

- Advisor: Prof. Tao Ju · Graphics and geometry processing
- GPA: 4.0/4.0

### Tsinghua University

M.E. IN SOFTWARE ENGINEERING

Beijing, China

Aug. 2015 - Jun. 2018

- Advisor: Prof. Hui Zhang & Prof. Dong-Ming Yan · Triangle and quad remeshing
- GPA: 3.7/4.0, Rank: 1/131, Graduate with Honors

### Tsinghua University

B.E. IN MATERIAL SCIENCE AND ENGINEERING (PHYSICS BRANCH)

Beijing, China

Aug. 2011 - Jun. 2015

- GPA: 91/100
- Minor in Computer Science

## Research Interests

Computer graphics, Geometry processing, Geometric modeling, Optimization

## Publications

### Optimizing Global Injectivity for Constrained Parameterization

XINGYI DU, DANNY M. KAUFMAN, QINGNAN ZHOU, SHAHAR Z. KOVALSKY, YAJIE YAN, NOAM AIGERMAN, TAO JU

ACM Transactions on Graphics (Proc. SIGGRAPH Asia 2021)

### Boundary-Sampled Halfspaces: A New Representation for Constructive Solid Modeling

XINGYI DU, QINGNAN ZHOU, NATHAN CARR, TAO JU

ACM Transactions on Graphics (Proc. SIGGRAPH 2021)

### Lifting Simplicies to Find Injectivity

XINGYI DU, NOAM AIGERMAN, QINGNAN ZHOU, SHAHAR KOVALSKY, YAJIE YAN, DANNY M. KAUFMAN, TAO JU

ACM Transactions on Graphics (Proc. SIGGRAPH 2020)

### Field-Aligned Isotropic Surface Remeshing

XINGYI DU, XIAOHAN LIU, DONG-MING YAN, CAIGUI JIANG, JUNTAO YE, HUI ZHANG

Computer Graphics Forum (Proc. Eurographics 2018)

### Quad Mesh Generation via Field-Aligned Centroidal Voronoi Tessellation

XINGYI DU, DONG-MING YAN, JUNTAO YE, HUI ZHANG

China CAD&CG (Proc. China CAD&CG 2017)

## Research Experience

### Solid Modeling Representations and Algorithms

COLLABORATION: WASHU, ADOBE RESEARCH

2020 - ongoing

- Proposed a novel representation for solid shapes based on halfspaces and sample points. Compared to traditional Constructive Solid Geometry (CSG), our representation is more intuitive to understand and edit, and straightforward for reverse engineering (conversion from meshes or point clouds).
- Developed an interactive 3D modeling software based on our representation, which utilizes mesh arrangement, graph-cut, and state-space search to extract a 3D surface from user inputs.
- Designed a pipeline to convert meshes into our representation, which included surface segmentation, primitive fitting using RANSAC, and point cloud fitting by implicit surfaces.
- Paper "Boundary-Sampled Halfspaces: A New Representation for Constructive Solid Modeling" is accepted to Siggraph 2021.

## Injectivity Optimization for Simplicial Maps

COLLABORATION: WASHU, ADOBE RESEARCH, FACEBOOK REALITY LABS AND DUKE UNIVERSITY

2018 - ongoing

- Proposed novel energies that capture the non-injectivity of simplicial maps. The energies are sufficiently smooth for gradient-based optimization, and their global minima have theoretical guarantees for injectivity. By optimizing the energy, injective maps are recovered from non-injective initialization, possibly under boundary and positional constraints.
- Derived the gradient/Hessian of our energy and designed quasi-Newton and projected-Newton solvers for efficient optimization.
- Constructed two benchmark datasets (thousands of meshes) for evaluating state-of-art injective mapping methods.
- Paper "Lifting Simplices to find Injectivity" is accepted to Siggraph 2020.
- Paper "Optimizing Global Injectivity for Constrained Parameterization" is accepted to Siggraph Asia 2021.

## Remeshing via Field-aligned Centroidal Voronoi Tessellations(CVT)

COLLABORATION: TSINGHUA UNIVERSITY, CHINESE ACADEMY OF SCIENCES

2016 - 2018

- Proposed a novel approach for isotropic triangular remeshing by augmenting CVT with an energy term that promotes alignment of mesh edges to the user-defined directional field.
- Extended the approach to quad-dominant mesh generation. To further improve mesh quality, proposed an efficient algorithm to match mesh edges and field direction.
- Paper "Quad Mesh Generation via Field-Aligned Centroidal Voronoi Tessellation" is accepted to China CAD&CG 2017.
- Paper "Field-Aligned Isotropic Surface Remeshing" is accepted to Eurographics 2018.

## Interactive Quad-mesh Design via Topology Patterns

TSINGHUA UNIVERSITY

2016

- Simplified the topology patterns in the pattern database proposed in the paper "Data-driven Interactive Quadrangulation"(DDQ). Reduced the size of the database by more than half.
- To further simplify the patterns, designed an algorithm to identify equivalent topology patterns up to rotation and mirror symmetry.
- Developed a GUI program (shared on GitHub) to visualize and edit topology patterns in the database.

## Work Experience

### Solid Modeling based on Implicit Representation

ADOBE RESEARCH

Summer 2021

- Surveyed the literature of implicit surfacing and curve/surface arrangement (including robust methods that adaptively sample the space to guarantee isotopy). Identified promising research directions in modeling based on implicit representation.
- Implemented a modified quasi-Newton solver for efficient optimization in geometry processing. Testing showed improved performance on mesh parameterization and deformation.

### Morphable Human Face Reconstruction from RGB-D Images

MEGVII (FACE++) RESEARCH

Summer 2017

- Developed a pipeline to reconstruct 3D models from RGB-D photos of human faces. The pipeline includes rigid registration based on Iterative Closest Point, and non-rigid registration by fitting a morphable face model to point clouds. The fitting considers reconstruction error, as well as landmark correspondence, silhouette matching, and shape regularity.

## Service

### ACADEMIC

- 2020 **Reviewer**, Computers & Graphics
- 2020 **Reviewer**, SPM (Solid and Physical Modeling)

### TEACHING

- 2020 **TA**, CSE554: Geometric Computing for Bio-medicine WashU
- 2019 **TA**, CSE546: Computational Geometry WashU
- 2016 **TA**, Digital Media I: Graphics and Animation Tsinghua

## Skills

- Programming** Mathematica, C++, Python
- Math** Linear Algebra, Real/Complex Analysis, Statistics, Topology, Measure Theory, Functional Analysis
- Languages** Chinese, English