Xingyi **Du**

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Education

Washington University in St. Louis — *St. Louis, USA*

PH.D. CANDIDATE IN COMPUTER SCIENCE — *Aug. 2018 - present*

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

Tsinghua University — *Beijing, China*

M.E. IN SOFTWARE ENGINEERING — *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 — *Beijing, China*

B.E. IN MATERIAL SCIENCE AND ENGINEERING (PHYSICS BRANCH) — *Aug. 2011 - Jun. 2015*

- GPA: 91/100
- Minor in Computer Science

Research Interests

Computer graphics, Geometry processing, Geometric modeling, Optimization, Deep Learning

Publications

Isometric Energies for Recovering Injectivity in Constrained Mapping

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

ACM Transactions on Graphics (Proc. SIGGRAPH Asia 2022) (Conditionally Accepted)

Robust Computation of Implicit Surface Networks for Piecewise Linear Functions

XINGYI DU, QINGNAN ZHOU, NATHAN CARR, TAO JU

ACM Transactions on Graphics (Proc. SIGGRAPH 2022)

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 Simplices 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

Multi-function Implicit Representations

Collaboration: WashU, Adobe Research *2020 - ongoing*

- Proposed a novel representation for piecewise smooth solid shapes based on halfspaces and sample points. Compared to the 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 create 3D solid shapes from sparse user inputs.
- Proposed a robust approach to polygonize implicit surface networks (e.g., implicit arrangement, material interfaces) on tetrahedron grids. The core algorithms leverage plane-based point representation and barycentric coordinates to accelerate plane intersection computing without sacrificing accuracy. We further improved efficiency by using look-up tables and a novel space decomposition algorithm.
- Paper "Boundary-Sampled Halfspaces: A New Representation for Constructive Solid Modeling" is accepted to Siggraph 2021.
- Paper "Robust Computation of Implicit Surface Networks for Piecewise Linear Functions" is accepted to Siggraph 2022.

Optimizing Injectivity for Simplicial Maps

Collaboration: WashU, Adobe Research, Meta Reality Labs and Duke University *2018 - ongoing*

- Proposed novel energies that measure 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, we recover injective maps from non-injective initialization with a high success rate. This approach supports 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.
- Extended the energies to generate injective mappings with low isometric distortion.
- Paper "Lifting Simplices to find Injectivity" is accepted to Siggraph 2020.
- Paper "Optimizing Global Injectivity for Constrained Parameterization" is accepted to Siggraph Asia 2021.
- Paper "Isometric Energies for Recovering Injectivity in Constrained Mapping" is conditionally accepted to Siggraph Asia 2022.

Remeshing via Field-aligned Centroidal Voronoi Tessellations(CVT)

Collaboration: Tsinghua University, Chinese Academy of Sciences *2016 - 2018*

- Proposed a new approach for isotropic triangular remeshing by introducing a novel field alignment energy term in the CVT optimization. The resulting mesh has better angle quality and fewer singularity artifacts.
- 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.

Data-driven Interactive Quad-mesh Design

Tsinghua University *2016*

- Simplified the topology patterns in the database of 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*

Research Intern *Summer 2021*

- Surveyed the literature on 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*

Research Intern *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

2022 **Reviewer,** Siggraph
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 C++, Python, Mathematica

Math Linear Algebra, Real/Complex Analysis, Statistics, Topology, Measure Theory, Functional Analysis

Languages Chinese, English