ZIQIU ZENG

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RESEARCH VISION

Robotic intelligence will not scale without a new generation of physics infrastructure.
My research establishes the **simulation layer** that enables contact-rich manipulation, deformable interaction, and physically grounded learning. I design physics engines as **computational operating systems for robotics** — systems that unify contact mechanics, differentiation, GPU-scale solvers, and policy optimization under a coherent architecture.

RESEARCH AREAS

Physics Engines for Robotics · Contact Mechanics · Differentiable Simulation · GPU Numerical Architecture · Sim-to-Real for Manipulation

ACADEMIC APPOINTMENTS

Human-Centered Robotics Lab, National University of Singapore   Singapore
Research Manager   2025–Present

Center of Artificial Intelligence and Robotics, Chinese Academy of Science   Hong Kong S.A.R., China
Postdoctoral Researcher (promoted to Assistant Professor, 2025)   2023–2025

EDUCATION

Ph.D., Computer Graphics   University of Strasbourg, France, 2023
Engineering Degree, Automation   University of Technology of Troyes, France, 2019
B.Sc., Computer Science   University of Shanghai, China, 2017

PUBLICATIONS

1. Fast But Accurate: A Real-Time Hyperelastic Simulator with Robust Frictional Contact.
   Z. Zeng, et al.   *ACM Transactions on Graphics (Proc. ACM SIGGRAPH 2025)*

2. Taming the Elephant in the Room: Fast and Reliable Gradients for Deformables Across Frictional Contact Regimes
   Z. Zeng, et al.   *Under review, ACM SIGGRAPH 2026.*

3. FLASH: Fast Learning via GPU-Accelerated Simulation for High-Fidelity Deformable Manipulation in Minutes.
   S. Luo, …, **Z. Zeng***, F. Shi   *Under review, RSS 2026.*

4. Few-Shot Neural Differentiable Simulator: Real-to-Sim Rigid-Contact Modeling.
   Z. Huang, …, **Z. Zeng**, F. Shi   *ICRA 2026*

5. Real-Time FE simulation for Large-Scale Problems using Precondition-Based Contact Resolution and Isolated DOFs Constraints.
   Z. Zeng, et al.   *Computer Graphics Forum 2022*

6. Dynamic Cutting Simulation using Elastic Snapping for Mesh Quality Optimization.
   Z. Zeng, et al.   *Computer Graphics Forum 2025*

RESEARCH EXPERIENCE

National University of Singapore
College of Design and Engineering, Human-Centered Robotic Lab   Singapore
Research Manager, Simulation Lead   2025 – Now
Lead architect of the lab's physics engine for contact-rich robotic manipulation.

- Architected the lab-wide residual-based simulation framework supporting rigid–deformable interaction.
- Designed GPU-native contact solvers enabling real-time frictional mechanics at scale.
- Established modular system interfaces connecting simulation, policy learning, and robot control.
- Directed integration of differentiable physics into manipulation and locomotion pipelines.
- Coordinated cross-team deployment from simulation to hardware experiments.
- Mentored and supervised students developing core engine modules and downstream robotics systems.

Chinese Academy of Science
Hong Kong Institute of Science & Innovation, Center of AI and Robotics   Hong Kong S.A.R., China
Postdoctoral Researcher → Assistant Professor (2025)   2023–2025
Technical lead for a high-performance physics simulation platform for robotics and medical applications.

- Architected system-level solver design enabling stable interactive performance under large deformation.
- Directed a team building a virtual surgical training environment integrating visual and haptic feedback.
- Coordinated simulation integration with surgical robotics systems (vascular navigation, needle insertion).
- Established scalability and robustness standards for deployment-grade interactive systems.

University of Strasbourg
INRIA Mimesis Team & ICube Laboratory   Strasbourg, France
Ph.D. Researcher   2019–2023
Established scalable numerical foundations for real-time deformable simulation within the SOFA ecosystem.

- Designed preconditioned contact-resolution methods for large-scale finite element systems.
- Engineered solver architectures enabling real-time frictional contact under large deformation.
- Contributed core modules to an open simulation framework used in medical and robotics research.
- Bridged numerical methods and deployable interactive systems.

INVITED TALKS & POSTERS

ETH Zurich CRL Seminar	April 2025
ICRA 2025 Workshop Session	May 2025
NUS AI Research Day Poster Session	July 2025
RAS TC Model-Based Optimization for Robotics Poster Session	July 2025
CORL 2025 Workshop Session	Sept 2025
SIGGRAPH ASIA 2025 Poster Session & Invited Poster Session	Dec 2025

GRANTS & RESEARCH FUNDING

NVIDIA Academic Grant (2025)
"Adaptive Fault-Tolerant Safe Locomotion with Differentiable Simulation"

Swiss AI Initiative Small Grant (2025)
Grant supporting "Learning Deformable Contact Dynamics for 4D Spatial Intelligence"

Google Research Funding (2025)
"Sim-to-Dex: Contact-Rich Graph Neural Models for Robotic Manipulation"

PROFESSIONAL SERVICE

Organizer, ICRA 2026 Workshop "Synthetic Data for Robot Learning"