# Tobias Pfaff

Understanding and modeling the world using ML.

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Cambridge, United Kingdom

## RESEARCH & WORK EXPERIENCE

**Google DeepMind, London, UK** 2017 - 2025
Staff research scientist (L6)
Learned physics simulations, RL, GNNs, generative video models

**Avametric, San Francisco, USA** 2015 - 2017
Research scientist, Simulation team lead
State-of-the art cloth simulation, learned physics models

**Double Fine Productions, San Francisco, USA** 2014 - 2015
Game programmer
UI & Rendering for "Grim Fandango remastered"

**UC Berkeley, USA** 2013 - 2014
Postdoctoral fellow, Computer graphics lab
Fracture, cloth & thin shell simulations

**ETH Zürich, Switzerland** 2008 - 2012
Research assistant, Computer graphics lab
Fluid simulation, real-time physics, data-driven methods

**CAS Lanzhou, China** 2007
Visiting researcher, Soil physics group
Inverse solvers for ERT in permafrost studies

**Bosch GmbH, Germany** 2006
Research intern, Vision & Optics group
3D optical scanning

**KAIST Research Center, Korea** 2005
Visiting researcher, AI Media Lab
Modeling friction in robotics

**Universität Konstanz, Germany** 2002
Research assistant, Solid-state physics lab
Data processing for acoustic microscopy

## EDUCATION

**Ph.D., Computer science** 2008 - 2012
ETH Zürich, Switzerland; Advisor: Prof. Markus Gross
Thesis: Detail enhancement for Fluid Animation

**M. Sc., Physics** 2001 - 2007
Universität Konstanz, Germany
Thesis: Numerical modeling and joint inversion of ERT

**B. Sc., Computer science (dual degree)** 2003 - 2006
Universität Hagen, Germany

## AWARDS AND HONORS

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|---|---|
| ICLR best paper award | 2021 |
| SNSF postdoctoral fellowship | 2012 - 2014 |
| ETH independent investigators award | 2008 |
| DAAD exchange scholarship | 2005 |
| JASSO (Japanese Education Department) fellowship | 2003 - 2004 |
| Full scholarship, Studienstiftung des deutschen Volkes | 2001 - 2007 |
| National winner, German national computer science competition (Bundeswettbewerb) | 2000 |

## NOTABLE RESEARCH ARTIFACTS

Google Veo (link)
Core contributor for Google's large generative video model

AlphaStar (link)
Core contributor for the DeepMind's Grandmaster-level Starcraft agent

MantaFlow fluid solver (link)
Developed during my PhD, now the default fluid solver in Blender

ARCSim cloth & fracture simulator (link)
Developed during my postdoc, now powers the commercial Accumark3D software

Filed 10 patents on my research (link)

## SELECTED PEER-REVIEWED PUBLICATIONS [FULL SCHOLAR PROFILE]

- Learning rigid-body simulators over implicit shapes for large-scale scenes and vision
Y Rubanova, T Lopez, K Allen, W Whitney, K Stachenfeld, **T Pfaff**. NeurIPS 2024 [**oral**]

- Learning 3D particle-based simulators for RGB-D video
W Whitney, T Lopez, **T Pfaff**, Y Rubanova, T Kipf, K Stachenfeld. ICLR 2024

- Graph network simulators can learn discontinuous, rigid contact dynamics
K Allen, T Lopez, Y Rubanova, K Stachenfeld, A Sanchez, P Battaglia, **T Pfaff**. CoRL 2023

- Learning rigid dynamics with face interaction graph networks
K Allen, Y Rubanova, T Lopez, W Whitney, A Sanchez, P Battaglia, **T Pfaff**. ICLR 2023

- Physical design using differentiable learned simulators
K Allen, T Lopez, K Stachenfeld, A Sanchez, P Battaglia, J Hamrick, **T Pfaff**. NeurIPS 2022

- Predicting physics in mesh-reduced space with temporal attention
X Han*, H Gao*, **T Pfaff***, J Wang, L Liu. ICLR 2022

- Constraint-based graph network simulator
Y Rubanova, A Sanchez, **T Pfaff**, P Battaglia. ICML 2022

- Learned Coarse Models for Efficient Turbulence Simulation
K Stachenfeld, D Fielding, D Kochkov, M Cranmer, **T Pfaff**, J Godwin, C Cui, S Ho, A. Sanchez. ICLR 2022

- Learning mesh-based simulation with graph networks
**T Pfaff***, M Fortunato*, A Sanchez, P Battaglia. ICLR 2021 [**Best paper award**]

- Learning to simulate complex physics with graph networks
A Sanchez*, J Godwin*, **T Pfaff***, R Ying, J Leskovec, P Battaglia. ICML 2020

- Combining q-learning and search with amortized value estimates
J Hamrick, V Bapst, A Sanchez, **T Pfaff**, T Weber, L Buesing, P Battaglia. ICLR 2020

- Grandmaster level in StarCraft II using multi-agent reinforcement learning
The AlphaStar team. Nature 2019

- Playing hard exploration games by watching Youtube
Y Aytar, **T Pfaff**, D Budden, T Paine, Z Wang, N de Freita. NeurIPS 2018 [**spotlight**]

- Adaptive tearing and cracking of thin sheets
**T Pfaff**, R Narain, J de Joya, J O'Brien. SIGGRAPH 2014

- Folding and crumpling adaptive sheets
R Narain, **T Pfaff**, J O'Brien. SIGGRAPH 2013

- Lagrangian vortex sheets for animating fluids
**T Pfaff**, N Thurey, M Gross. SIGGRAPH 2012

- Scalable fluid simulation using anisotropic turbulence particles
**T Pfaff**, N Thurey, J Cohen, S Tariq, M Gross. SIGGRAPH Asia 2010

- Synthetic turbulence using artificial boundary layers
**T Pfaff**, N Thurey, A Selle, M Gross. SIGGRAPH Asia 2009

- Field-scale apparent hydraulic parameterisation obtained from TDR time series and inverse modeling
U Wollschlager, **T Pfaff**, K Roth. Hydrology & Earth systems 2009

## COMMUNITY & PROFESSIONAL ACTIVITIES

- Reviewer for major ML and Graphics conferences (NeurIPS, ICML, ICLR, ToG, SIGGRAPH, etc.)
  Outstanding reviewer award for ICML and NeurIPS.

- Advised 3 master students, 1 PhD student. Mentor for 5 Googlers. Mentored for DL Indaba, M2L.

- Organized and led multiple research efforts at Google DeepMind.

- Invited talks at Imperial, UCL, UBC, Stanford, NYU, ETH Zurich, TU Munich, TU Berlin, Flatiron, LLNL, NAFEMS, Adobe, Dreamworks, Meta.

## TECHNICAL SKILLS

Data: Data generation with simulators, Large-scale processing pipelines, quality annotation, filtering

Modeling: GNNs, Transformers, Large sharded model training, GPU/TPU debugging

Programming Languages: Python, C++, C#, JS

Frameworks: JAX, Tensorflow, CUDA, Apache Beam

Professional tools: Blender, Unity, Photoshop, Premiere, COMSOL, OpenFOAM