

# Simon Le Cleac'h

Cambridge – Massachusetts

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✓ Work authorization with Optional Practical Training

## Education

### Stanford University

*Ph.D candidate in Mechanical Engineering, Specialization in Robotics, Optimization and AI.*

**Stanford**

2019–Present

Co-advised by Zachary Manchester & Mac Schwager, my research focuses on developing fast optimization algorithms for simulation, planning, and control for robotic systems. I am designing and implementing a differentiable physics simulator and leveraging this tool for trajectory tracking [1, 2, 3, 4], trajectory optimization and reinforcement learning tasks in robotic locomotion and manipulation. Previously, I implemented optimization algorithms enabling game-theoretic reasoning for autonomous vehicles [6,7,9].

### Stanford University

*Master of Mechanical Engineering, Specialization in Robotics and AI.*

**Stanford**

2017–2019

GPA – 4.0/4.0

Coursework: Machine Learning, Convolutional Neural Network for Visual Recognition, Robotic Manipulation, Robotic Autonomy, Convex Optimization, Optimal Control, State Estimation, Aerial Robot Design.

### Ecole Centrale Paris

*Master of Science in Engineering, Applied Mathematics.*

**Paris**

2015–2017

GPA – 4.2/4.0, ranked 4<sup>th</sup> out of 535 students.

Coursework: Statistics, Probability, Discrete Optimization, Embedded Systems, Control Theory, Parallel Computing, Database.

## Experience

### Research Scientist, Boston Dynamics AI Institute

*Focused on developing new dexterous manipulation capabilities*

**Cambridge, MA**

June 2023 - Present

- Synthesize contact-rich policies via robot learning methods, optimization & differentiable physics.

### Robotics Research Internship, Google Brain

*Developed optimization-based tools for contact simulation and long-horizon planning.*

**New York**

Summer 2022

- Unified collision detection and contact dynamics as a single optimization problem.
- Implemented an interior-point solver for non-linear complementarity problems to simulate and differentiate contact dynamics.

### Robotic Autonomy Project, Stanford University

*Implemented a robotic autonomy stack on a TurtleBot using ROS.*

**Stanford**

Fall 2019

- Implemented a deep learning inference pipeline on board to detect and classify objects using camera input.
- Exploited LIDAR data to build a map of an unknown environment, then planned trajectories online to reach goal points.
- Designed an actuator controller to execute the planned trajectories.

### Software Engineering Internship, Aurora Innovation

*Involved in autonomous driving technology development as part of the motion planning team.*

**Palo Alto**

Summer 2018

- Developed a learning-based approach to improve the interaction of the autonomous vehicle with pedestrians and cyclists.
- Designed classification features and built a pedestrian interaction dataset from autonomous vehicle logs.
- Designed, trained and tested a deep learning model to take decision with respect to pedestrians.

### Research Assistant, Stanford AI Lab

*Programming a deep learning application in robotics.*

**Stanford**

Winter 2018

- Designed a Recurrent Neural Network for estimating an object's physical properties through contact interaction.
- Implemented a probabilistic filter to fuse sensory data containing images and force/torque measurements.

## Software

### Silico: Single-level Differentiable Contact Simulation.

*Introduced a formulation unifying collision detection and contact dynamics as a single problem.*

**New York City**

2022

<https://github.com/simon-lc/Silico.jl>

### Dojo: Differentiable Physics Engine for Robotics.

*Developed a state-of-the-art physics engine for rigid-body contact simulation*

**Stanford**

2022

<https://github.com/dojo-sim/Dojo.jl>

## ALGAMES: Software Package for solving dynamic games.

Implemented a state-of-the-art solver for constrained dynamic game

<https://github.com/RoboticExplorationLab/Algames.jl>

Stanford

2020

## Skills

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**Programming:** PYTHON, C++, JULIA

**Computational:** LATEX, GIT, LINUX, IPOPT, CVX/CONVEX.JL, MESH2D

**Language:** English (bilingual), French (native), Spanish (Conversational), German (basic skills)

## Publications

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- [1] **S. Le Cleac'h**, M. Schwager, Z. Manchester, V. Sindhvani, P. Florence, S. Singh, Single-Level Differentiable Contact Simulation, *Robotics and Automation Letters* (RA-L & IROS 2023).
- [2] **S. Le Cleac'h\***, T. Howell\*, Z. Kolter, M. Schwager, Z. Manchester, Dojo: A Differentiable Physics Engine for Robotics, *Transactions on Robotics* (T-RO 2023, submitted).
- [3] **S. Le Cleac'h**, H. Yu, M. Guo, T. Howell, R. Gao, J. Wu, Z. Manchester, M. Schwager, Differentiable Physics Simulation of Dynamics-Augmented Neural Objects, *Robotics and Automation Letters* (RA-L & IROS 2023).
- [4] **S. Le Cleac'h\***, T. Howell\*, S. Yang, C. Lee, J. Zhang, A. Bishop, M. Schwager, Z. Manchester, Fast Contact-Implicit Model Predictive Control, *Transactions on Robotics* (T-RO 2023).
- [5] T. Howell, **S. Le Cleac'h**, M. Schwager, Z. Manchester, Trajectory Optimization with Optimization-Based Dynamics, *Robotics and Automation Letters* (RA-L & ICRA 2022).
- [6] **S. Le Cleac'h**, M. Schwager, Z. Manchester, ALGAMES: A Fast Augmented Lagrangian Solver for Constrained Dynamic Games, *Autonomous Robots* (AuRo 2021).
- [7] **S. Le Cleac'h**, M. Schwager, Z. Manchester, LUCIDGames: Online Unscented Inverse Dynamic Games for Adaptive Trajectory Prediction and Planning, *Robotics and Automation Letters* (RA-L & ICRA 2021).
- [8] R. Derollez, **S. Le Cleac'h**, Z. Manchester, Robust Entry Vehicle Guidance with Sampling-Based Invariant Funnel, *IEEE Aerospace Conference* (AeroConf 2021).
- [9] **S. Le Cleac'h**, M. Schwager, Z. Manchester, ALGAMES: A Fast Solver for Constrained Dynamic Games, *Robotics: Science and Systems* (RSS 2020).
- [10] **S. Le Cleac'h**, Z. Manchester, Fast Solution of Optimal Control Problems with L1 Cost, *Astrodynamics Specialist Conference* (AAS/AIAA 2019).

## Talks and Presentations

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- Control Through Contact via Differentiable Optimization** (slides)  
Advanced Mechanical Bipedal Experimental Robotics (AMBER) Laboratory, Caltech. November 2023
- Single-Level Differentiable Contact Simulation** (video) (slides) (poster)  
International Conference on Intelligent Robots and Systems (IROS), Detroit. October 2023
- Differentiable Physics Simulation of Dynamics-Augmented Neural Objects** (video) (slides) (poster)  
International Conference on Intelligent Robots and Systems (IROS), Detroit. October 2023
- Towards Efficient Optimization Through Contact: Simulation, Gradients, and Algorithms** (poster)  
RSS Pioneers Workshop, Daegu, South Korea. July 2023
- Numerical Optimization for Robotics Control and Simulation** (slides)  
The Boston Dynamics AI Institute, Cambridge, MA. March 2023
- Dojo: Differentiable Physics Engine for Robotics** (slides)  
Skydio, San Mateo, CA. March 2023
- Joint Prediction and Planning for Autonomous Vehicles** (slides)  
NVIDIA Autonomous Vehicle Research Group, Santa Clara, CA. March 2023
- Numerical Optimization for Robotics Control and Simulation** (slides)  
Figure AI, Sunnyvale, CA. March 2023
- Control Through Contact via Differentiable Optimization** (slides)  
Honda Research Institute (HRI), San Jose, CA. February 2023
- Composable Optimization for Robotics Simulation and Control** (slides)  
PhD Defense, Stanford. January 2023
- Differentiable Physics: Simulation, Planning and Control** (slides)  
Toyota Research Institute (TRI), Los Altos, CA. November 2022

<b>Dynamics-Augmented Neural Objects</b> (poster) Bay Area Robotics Symposium, BARS 2022, University of California, Berkeley.	<i>November 2022</i>
<b>Dojo: A Differentiable Physics Engine for Robotics</b> (slides) (poster) Differentiable Physics for Robotics workshop, RSS 2022, New York City. (w/ T. Howell)	<i>July 2022</i>
<b>Fast Contact-Implicit Model-Predictive Control</b> (slides) (poster) The Science of Bumping into Things workshop, RSS 2022, New York City. (w/ T. Howell)	<i>July 2022</i>
<b>Leveraging Differentiable Physics for Contact-rich Robotic Control</b> (slides) Google Brain Robotics, New York City.	<i>August 2022</i>
National Institute for Research in Digital Science and Technology (INRIA) Willow Team, Paris.	<i>June 2022</i>
Interactive Perception and Robot Learning Laboratory, Stanford University.	<i>May 2022</i>
<b>NeRF-ysics: Dynamics-Augmented Neural Objects</b> (poster) Motion Planning with Implicit Neural Representations of Geometry workshop, ICRA 2022, Philadelphia.	<i>May 2022</i>
<b>Dojo: A Differentiable Simulator for Robotics</b> (slides) Apple Research.	<i>August 2022</i>
Search-based Planning Laboratory, Carnegie Mellon University.	<i>August 2022</i>
Microsoft Research. (w/ T. Howell)	<i>May 2022</i>
Scientific Machine Learning (SciML) webinar, Carnegie Mellon University. (w/ T. Howell)	<i>April 2022</i>
SystemX lunch seminar, Stanford University. (w/ T. Howell)	<i>March 2022</i>
<b>Contact-Implicit Model-Predictive Control</b> (slides) Machines in Motion Laboratory, New York University. (w/ T. Howell)	<i>December 2021</i>
Locomotion Seminar, Carnegie Mellon University. (w/ T. Howell)	<i>November 2021</i>
<b>Linear Contact-Implicit Model-Predictive Control</b> (poster) Dynamic Walking 2021.	<i>May 2021</i>
<b>ALGAMES: A Fast Solver for Constrained Dynamic Games</b> (video) Robotics: Science and Systems, RSS 2020.	<i>June 2020</i>
<b>ALGAMES: A Fast Solver for Constrained Dynamic Games</b> (poster) Bay Area Robotics Symposium, BARS 2019, University of California, Berkeley.	<i>November 2019</i>

## Teaching

<b>Teaching Assistant, Stanford University</b>	<b>Stanford</b>
CS231N: Convolutional Neural Networks for Visual Recognition taught by Fei-Fei Li.	<i>Spring 2019</i>
CS326: Topics in Advanced Robotic Manipulation taught by Jeannette Bohg.	<i>Fall 2018</i>
ME300B: Partial Differential Equations in Engineering taught by Sanjiva Lele.	<i>Winter 2017</i>

## Awards

**RSS Pioneers 2023:** 1 of 30 selected as "the world's top early career researchers" in Robotics.  
**Walter-Zellidja Fellowship**, received from the Académie Française, the most prestigious institution for the French language and culture, to support my studies in the United-States.

## Professional Activities

### Mentoring

John Tucker, currently PhD candidate at Stanford University.  
Jan Brüdigam, currently PhD candidate at the Technical University of Munich.

### Professional Service

Co-organizer, Workshop on Leveraging Models for Contact-Rich Manipulation, International Conference on Intelligent Robots and Systems (IROS), 2023.

### Academic Reviewer

**Conference on Robot Learning (CoRL):** 2023  
**Robotics: Science and Systems (RSS):** 2023  
**Learning for Decision and Control (L4DC):** 2022  
**Transactions on Robotics (T-RO):** 2021, 2022, 2023  
**Robotics and Automation Letters (RA-L):** 2021, 2022, 2023  
**International Conference on Robotics and Automation (ICRA):** 2022

**International Conference on Intelligent Robots and Systems (IROS): 2020, 2023**

last updated, 26<sup>th</sup> December 2023