Sébastien Kleff

Postdoctoral researcher at INRIA Bordeaux

Education

01/09/2019–15/05/2024 **PhD in Electrical Engineering**, *New York University (NYU)*, New York, USA.
Co-advised by Ludovic Righetti (NYU) et Nicolas Mansard (LAAS-CNRS).
Thesis: Toward Force Feedback in Model-Predictive Control.
PhD degree awarded on 15/05/2024.

01/09/2016–15/03/2019 **MSc in Control Science and Engineering**, *Shanghai Jiao Tong University*, Shanghai, China.
Double degree in international partnership with Ecole Centrale de Nantes.
Project: Reachability analysis for robust motion planning (supervised by Ning Li)

01/09/2013–02/04/2019 **MSc ("Diplôme d'Ingénieur")**, *Ecole Centrale de Nantes*, Nantes, France.
General engineering curriculum with specialization in robotics.

01/09/2011–31/08/2013 **Preparatory Classes ("Classes Prépas")**, *Lycée Pierre d'Ailly*, Compiègne, France.
Mathematics and physics (field "MPSI/MP").

Professional experience

Since 01/09/2024 **Postdoctoral researcher**, *INRIA Bordeaux*, Bordeaux, France.
Postdoc in the AUCTUS project-team.

01/05/2024 – 31/08/2024 **Postdoctoral associate**, *NYU*, New York, USA.
Machines in Motion Laboratory, Electrical & Computer Engineering (ECE) Dept.

01/09/2022 – 30/04/2024 **Research assistant**, *NYU*, New York, USA.
Machines in Motion Laboratory, ECE Dept.

05/10/2020 – 31/08/2022 **Research engineer ("Ingénieur d'étude")**, *LAAS-CNRS*, Toulouse, France.
International mobility in the Gepetto Team in the context of the PhD co-supervision with NYU.

01/09/2019 – 04/10/2020 **Research assistant**, *NYU*, New York, USA.
Machines in Motion Laboratory, ECE Dept.

01/03/2019 - 31/08/2019 **Research engineer ("Ingénieur d'étude")**, *UTC*, Compiègne, France.
Project: Development of a map-matching algorithm for localization integrity of autonomous vehicles.
Heudiasyc (SyRI team), european project ESCAPE in partnership with Renault.

01/09/2015 - 15/02/2016 **Research intern**, *Max Planck Institute for Intelligent Systems*, Tübingen, Germany.
Subject: Optimal control of bipedal locomotion for humanoids with under-actuated ankles. Autonomous Motion Department, Movement Generation and Control Group.

01/04/2014 - 31/08/2015 **Engineering intern**, *ARMOR Industrial Coding & Printing*, La Chevrolière, France.
Projects: Optimization of the production process and feasibility study on automatic packaging.

Main scientific achievements

2019-2024 Introduction of force feedback in Model-Predictive Control (MPC). In my PhD research, I have made pioneering conceptual, theoretical and experimental contributions to the field of MPC in robotics by allowing for the first time the control of physical interactions within the optimal control framework (see Publications, IROS 2022, ICRA 2024).

2023-2024 Design, implementation and deployment of state-of-the-art numerical optimal control solver on torque-controlled robots. In this collaborative project, I have made important conceptual and algorithmic contributions bridging a crucial gap between the robotics community and the control theory community, which allowed for the first time to achieve nonlinear constrained MPC on torque-controlled robots in real-time. The code was open-source and built on top of a popular optimal control library in robotics (see the Software section).

2019-2020 First implementation of closed-loop nonlinear MPC on a torque-driven manipulator. During the first year of my PhD, I have demonstrated the feasibility and practicality of nonlinear MPC on a torque-controlled manipulator, thereby outperforming state-of-the-art and setting an important experimental and conceptual milestone for his community (see Publications, ICRA 2021, 112 citations).

Scholarships and awards

02/2025 **Seal of Excellence** of the Marie-Skłodowska-Curie Action Postdoctoral Fellowship.

05/2024 **Best poster award** of the 2^{nd} Advancements in Trajectory Optimization and Model Predictive Control for Legged Systems (ATOMPC) Workshop at the IEEE ICRA 2024 conference.

09/2016–02/2019 **China Scholarhsip Council (CSC)** for international students. Funder: China's Ministry of Education. Amount: approx. 3000 RMB/month. Duration: 30 months. Acceptance: 10-30%

2015 **"Envoléo" scholarship** for student international mobility. Funder: Région Pays de la Loire. Amount: approx. 1k EUR.

Communications

Talks at international conferences

05/2024 **2024 IEEE International Conference on Robotics and Automation (ICRA)**, *Yokohama*, Japan, Force feedback model-predictive control using online estimation, A. Jordana*, **S. Kleff***, J. Carpentier, N. Mansard, L. Righetti.

10/2022 **2022 IEEE/RSJ International Conference on Robots and Intelligent Systems (IROS)**, *Kyoto*, Japan, Introducing force feedback in model-predictive control, **S. Kleff**, E. Dantec, G. Saurel, N. Mansard, L. Righetti.

11/2022 **2022 IEEE-RAS 21st International Conference on Humanoid Robots (Humanoids)**, *Okinawa*, Japan, On the derivation of the contact dynamics in arbitrary frames, **S. Kleff**, J. Carpentier, N. Mansard, L. Righetti.

06/2021 **2021 IEEE International Conference on Robotics and Automation (ICRA)**, *Xi'an*, China, High-frequency nonlinear model-predictive control of a manipulator, **S. Kleff**, A. Meduri, R. Budhiraja, N. Mansard, L. Righetti.

06/2018 **2018 Chinese Control And Decision Conference (CCDC)**, *Shenyang*, China, A sampled-data hamilton-jacobi reachability approach to safe and robust motion planning, **S. Kleff**, N. Li.

Invited talks at universities

09/2025 **Centre INRIA de l'Universite de Bordeaux**, *Talence*, France, "DIGEST" Seminar on Quadratic Optimization for Robotics organized by INRIA.

05/2025 **LAAS-CNRS**, *Toulouse*, France, Invited talk organized by the Gepetto Team.

01/2025 **Technical University of Munich (TUM)**, *Munich*, Germany, Invited talk organized by the Applied and Theoretical Aspects of Robot Intelligence Laboratory.

07/2024 **Harvard University**, *Cambridge*, USA, Invited talk "Toward force feedback in model-predictive control", organized by the Computational Robotics Group.

07/2024 **Massachusetts Institute of Technology**, *Cambridge*, USA, Invited talk "Toward force feedback in model-predictive control", organized by the Biomimetic Robotic Lab.

02/2024 **Columbia University**, *New York*, USA, Invited talk "Toward force feedback in model-predictive control", organized by the Robotic Manipulation and Mobility Lab.

02/2024 **INRIA Bordeaux**, *Bordeaux*, France, Invited talk "Toward force feedback in model-predictive control" organized by the AUCTUS team.

01/2023 **R4**, *(Online)*, Invited talk organized by the regional robotics network of Nouvelle-Aquitaine.

Participation in workshops, colloqiums and local conferences

05/2024 **ATOMPC Workshop at ICRA 2024**, *Yokohama*, Japan, Interactive (poster) sessions. Stagewise implementation of Sequential Quadratic Programming for Optimal Control. A. Jordana*, **S. Kleff***, A. Meduri*, J. Carpentier, N. Mansard, L. Righetti.

11/2023 **Northeast Robotics Colloqium at Yale University**, *New Haven*, USA, Interactive session. Stagewise implementation of Sequential Quadratic Programming for Optimal Control. A. Jordana*, **S. Kleff***, A. Meduri*, J. Carpentier, N. Mansard, L. Righetti.

07/2022 **Journées Nationales de la Robotique Humanoïde (JNRH 2022)**, *Angers*, France, Introducing force feedback in model predictive control. **S. Kleff**.

06/2021 **Journées Nationales de la Robotique Humanoïde (JNRH 2021)**, *Angers*, France, Predictive control on torque-controlled robots: experimental results. **S. Kleff**, E. Dantec.

Publications

Pre-prints

2024 **Sébastien Kleff**, Armand Jordana, Nicolas Mansard, and Ludovic Righetti. Force Feedback Model Predictive Control: A Soft Contact Approach. *Under review*, 2024.

Journals

2025 Armand Jordana*, **Sébastien Kleff***, Avadesh Meduri*, Justin Carpentier, Nicolas Mansard, and Ludovic Righetti. Structure-exploiting sequential quadratic programming for model-predictive control. *IEEE Transactions on Robotics*, volume 41, pages 4960–4974, 2025.

2025 Armand Jordana, **Sébastien Kleff**, Arthur Haffemayer, Joaquim Ortiz-Haro, Justin Carpentier, Nicolas Mansard, and Ludovic Righetti. Infinite-horizon value function approximation for model predictive control. *IEEE Robotics and Automation Letters*, volume 10, pages 7563–7570, 2025.

2020 **Sébastien Kleff** and Ning Li. Robust Motion Planning in Dynamic Environments Based on Sampled-Data Hamilton-Jacobi Reachability. *Robotica*, volume 38, 2020.

Conferences

2024 Armand Jordana*, **Sébastien Kleff***, Justin Carpentier, Nicolas Mansard, and Ludovic Righetti. Force Feedback Model-Predictive Control via Online Estimation. *Accepted to IEEE International Conference on Robotics and Automation (ICRA)*, 2024.

2022 **Sébastien Kleff**, Ewen Dantec, Guilhem Saurel, Nicolas Mansard, and Ludovic Righetti. Introducing Force Feedback in Model Predictive Control. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2022.

2022 **Sébastien Kleff**, Justin Carpentier, Nicolas Mansard, and Ludovic Righetti. On the Derivation of the Contact Dynamics in Arbitrary Frames (Application to Polishing with Talos). *IEEE-RAS International Conference on Humanoid Robots (Humanoids)*, 2022.

The * symbol means that the publication was an equal contribution collaboration between several authors.

2022 Amit Parag, **Sébastien Kleff**, Léo Saci, Nicolas Mansard, and Olivier Stasse. Value learning from trajectory optimization and sobolev descent: A step toward reinforcement learning with superlinear convergence properties. *IEEE International Conference on Robotics and Automation (ICRA)*, 2022. **Contribution** : I conducted the experimental validation, which includes providing optimal control problems on a manipulator, designing a scalable sampling strategy, training the Sobolev network, and producing figures. I also actively contributed to the paper writing and to the production of the accompanying video .

2022 Ahmad Gazar, Majid Khadiv, **Sébastien Kleff**, Andrea Del Prete, and Ludovic Righetti. Nonlinear stochastic trajectory optimization for centroidal momentum motion generation of legged robots. *The International Symposium of Robotics Research, ISR 2022*, 2022. **Contribution** : I contributed technically to the experimental validation (provided the friction cones formulation in moving coordinates) .

2021 **Sébastien Kleff**, Avadesh Meduri, Rohan Budhiraja, Nicolas Mansard, and Ludovic Righetti. High-Frequency Nonlinear Model Predictive Control of a Manipulator. *IEEE International Conference on Robotics and Automation (ICRA)*, 2021.

2018 **Sébastien Kleff** and Ning Li. A sampled-data Hamilton-Jacobi reachability approach to safe and robust motion planning. *2018 Chinese Control And Decision Conference (CCDC)*, 2018.

2017 Majid Khadiv, **Sébastien Kleff**, Alexander Herzog, S. Ali A. Moosavian, Stefan Schaal, and Ludovic Righetti. Stepping stabilization using a combination of DCM tracking and step adjustment. *4th RSI International Conference on Robotics and Mechatronics, ICRoM 2016*, 2017. **Contribution** : I designed and implemented a prototype of the proposed approach (the DCM trajectory generation and the whole-body QP formulation) during my undergraduate research internship at the Max Planck Institute .

Software

Since 11/2023 **`mim_solvers`**, Numerical optimal control solver based on Sequential-Quadratic Programming, Role: Main developer.
`https://github.com/machines-in-motion/mim_solvers`

Since 01/2022 **`crocoddyl`**, Optimal control library for robotics., Role: contributor. Main contribution: contact modeling in moving coordinates..
`https://github.com/loco-3d/crocoddyl`

Supervision

Since 10/2025 **Tianyi Jin**, *PhD student*, INRIA Bordeaux.
Tianyi is working on scenario-based MPC for human-robot collaboration.

Apr. 2024 - 08/2024 **Kloe Bonnet**, *M.Sc. student*, INRIA Bordeaux.
Kloe Bonnet worked on scenario-based MPC for human-robot collaboration.

Apr. 2022 - 08/2022 **Lison Kardassevitch**, *M.Sc. student*, LAAS-CNRS.
Lison Kardassevitch worked on modeling humanoid self-collision avoidance using learned ego-motion maps.

Apr. 2021 - 08/2021 **Hakim Cherfi**, *M.Sc. student*, LAAS-CNRS.
Hakim Cherfi worked worked on the parallelization of the backward pass of the DDP algorithm.

Teaching

2022 **EDEAF4Q1: Systèmes à événements discrets**, *Université Paul Sabatier III*, Toulouse.
Teaching assistant at Faculté de Sciences et Ingénierie (L2 EEA). Duration: 10h

2021 **ELEAF5A1: Informatique Industrielle**, *Université Paul Sabatier III*, Toulouse.
Teaching assistant at Faculté de Sciences et Ingénierie (L3 EEA). Duration: 24h

2021 Teaching assistant for the Reinforcement Learning Virtual School (RLVS) organized by ANITI

Mentoring

2024 Mentor of the ARISE program ARISE organized by NYU

2020 Mentor of the ARISE program ARISE organized by NYU

Services

Since 2024 Reviewer for Transactions on Robotics (IEEE TRO)

Since 2022 Reviewer for Robotics and Automation Letters (RAL) and IROS

Since 2021 Reviewer for ICRA

2018 Reviewer for CCDC