

Hanbang Gao

Curriculum Vitae

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DOCTORAL RESEARCH

“Management of Physical Human Interaction in Cable-Driven Parallel Robots (CDPRs). On advancing human-robot interaction in CDPRs by addressing two primary types of interactions: unintentional collisions and intentional collaboration. These interactions are further classified into human-cable and human-Moving Platform (MP) contacts, reflecting diverse scenarios encountered in industrial and logistics environments, where both safety and collaborative efficiency are paramount.”

The research addresses challenges arising from dynamic contacts by distinguishing two primary interaction scenarios: unintentional collisions and intentional collaboration. It incorporates sensor fusion within innovative perception and modeling methodologies. Frequency analysis supports precise detection through model-based approaches, in combination with reinforcement learning (Soft Actor Critic) techniques facilitate superior contact identification and adaptive control strategies. Key contributions include: (i) a novel validation of a cable release method that effectively detects, identifies, and manages human-cable collisions in CDPRs, accompanied by adaptive cable release algorithms; (ii) a novel contact distinction method based on frequency analysis to differentiate human-robot contacts, a technique extendable to robotic systems with varied materials; (iii) an adaptive compliant controller enabling the MP to follow predefined trajectories while exhibiting compliant behavior during human-MP collisions; and (iv) the development of a human-MP collaboration framework ensuring safe physical interactions.

ACADEMIC APPOINTMENTS

Nantes Université

SEP 2025 – PRESENT

Temporary Teaching and Research Associate

Academic appointment combining independent teaching and ongoing research activities. Delivered 192 hours of instruction within the GMP programme, covering robotics and mechanical design topics for both undergraduate and graduate students. Research activities were conducted within the LS2N laboratory.

RESEARCH EXPERIENCE

FEB 2022 – AUG 2022 (INTERNSHIP)

Laboratory of Digital Sciences of Nantes (LS2N)

Master 2 Internship: “Modelling, Simulation and Control of a Novel Aerial Cable Towed System for Agile Operation”

Supervised by Prof. Stephane Caro and prof. Chriette Abdelhamid. Conducted finite element modeling, implemented an

EDUCATION

OCT 2022 – **Doctor of Philosophy**
Mechanics and Robotics
École Centrale de Nantes

SEP 2020 – AUG 2022 **Master of Science**
SCORE: 3.3/4, BIEN
Advanced Robotics
École Centrale de Nantes

SEP 2019 – MAY 2020 **Bachelor (3rd-year Exchange)**
SCORE: 16,13/20, THESIS GRADE: 18/20
Signal, Control, and Robotics
École Centrale de Nantes

AUG 2016 – SEP 2019 **Bachelor of Engineering**
SCORE: 85/100, FIRST CLASS HONORS
Department of Automation
Beijing Institute of Technology

AWARDS

2025 **ERASMUS+ BIP Funding (1500€)**
Erasmus+ Programme

2022-2026 **Chinese Government Scholarship (65000€)**
China Scholarship Council

2020-2022 **Elite Tuition Fee Waivers (9000€)**
École Centrale de Nantes

2016-2019 **University Merit Scholarship**
Beijing Institute of Technology

SOFTWARE SKILLS

EXPERT Matlab, Simulink, CATIA

ADVANCED C++, Python, OpenCV, \LaTeX

EXPERIENCED ROS2, Gazebo, Linux, TensorFlow

FAMILIAR ROS xacro, DELMIA, PyTorch

LANGUAGE SKILLS

NATIVE Chinese

FLUENT English (C1+, TOEFL C1, 2017)

PROFICIENT French (C1, DALF C1, 2025)

BASIC Japanese (A2, Evaluation in Nantes Université, 2024)

TEACHING EXPERIENCE

Conception de mécanique

This L1 undergraduate engineering module (12 teaching hours) was delivered in French. It introduced computer-aided mechanical design (CAO/CAD) using 3DEXPERIENCE, with emphasis on parametric modelling, assemblies, and digital mock-up workflows.

LQR controller for drone control, and performed simulations using ROS2 and Gazebo. Completed six courses on ROS2 programming ([The Construct](#)) and one online drone course from [University of Pennsylvania](#). The associated [GitHub repository](#) received an additional 10 stars.

JUN 2021 – AUG 2021 (PROJECT)

École Centrale de Nantes

Master 1 Research Project: “Model Predictive Control Based on CARIMA Model”

Supervised by Prof. Guy Lebret in École Centrale de Nantes. Implemented model predictive control on a thermal system to counteract external disturbances, involving both theoretical study and hardware-in-loop testing using C and Simulink.

SEP 2019 – MAY 2020 (THESIS)

École Centrale de Nantes

Bachelor Thesis: “Research and Design of Virtual Arm Skeleton Control System Based on IMU”

Supervised by Dr. Konstantin Akhmadeev. Developed a virtual skeleton system using inertial motion tracking to animate movement, incorporating sensor fusion and data prototyping in Python. (Grade: 18/20)

COMMUNICATION SKILLS

POPULARIZATION	Co-facilitated public activities at Fête de la Science and Nuit Blanche Rechercheur in Nantes, 2024.
SCIENTIFIC	Keynote seminar on human-robot physical interaction research for Manufacturing21, Nantes, 2025 and GdR Robotique Journée, Paris, 2025.

REVIEW SERVICE

- **IEEE** *Transactions on Robotics* (2)
- **IEEE** *Robotics and Automation Letters* (4)
- **SAGE** *International Journal of Robotics Research* (2)
- **ASME** *Journal of Mechanisms and Robotics* (4)
- **WILEY** *Journal of Field Robotics*
- **SPRINGER** *Nonlinear Dynamics*

REFERENCES

Dr. Stéphane Caro

TITLE	CNRS Research Director
EMPLOYER	Laboratory of Digital Sciences of Nantes (LS2N)
POSITION	Head of the RoMaS Team
EMAIL	stephane.caro@ls2n.fr

Dr. Christine Chevallereau

TITLE	CNRS Research Director
EMPLOYER	Laboratory of Digital Sciences of Nantes (LS2N)
POSITION	Head of the ReV Team
EMAIL	christine.chevallereau@ls2n.fr

Chaîne numérique

This M1/M2 graduate engineering module (8 hours in M1 and 12 hours in M2) was delivered in French. It focused on end-to-end digital engineering workflows in 3DEXPERIENCE, including serial robot-arm modelling, equipment design and integration, and assembly/process simulation (incl. PPR).

Computer Aided Design

This undergraduate engineering module (32 teaching hours) was delivered in English. It covered CATIA V5 fundamentals through lectures and tutorials, focusing on part/surface/parametric modelling, detailing, assemblies, and introductory simulation and structural analysis.

FORMAL TRAINING

Fourth Summer School on Singularities of Mechanisms and Robotic Manipulators (simero 2023)

The purpose of this school is to introduce key methods, milestone results, and main problems involving singularities of mechanisms and robotic manipulators. The attendees were introduced to the mathematical theory needed to cope with singularities, but also to the software tools to compute and visualize them.

International Ph.D. Summer School on Mathematics and Machine Learning for Image Analysis (mml-imaging 2025)

The Summer School aims to tackle cross-cutting mathematical approaches to imaging sciences and machine/deep learning, essential for researchers interested in discovering the fascinating connections between these disciplines. The school aims at providing the students with both the theoretical and applied foundations of the mathematics of machine learning for imaging with an overview to challenging applications.

PUBLICATIONS

Hanbang Gao, Christine Chevallereau, Stéphane Caro. “Detection and Management of Human-Cable Collision in Cable-Driven Parallel Robots.” *IEEE Robotics and Automation Letters*, 2024, 9 (12), pp.11698-11705. [\(hal-04851656\)](#)

Hanbang Gao, Christine Chevallereau, Stéphane Caro. “Advancements in Human-Cable Collision Detection and Management in Cable-Driven Parallel Robots.” *Seventh International Conference on Cable-Driven Parallel Robots*, Jul 8-11, 2025, Hongkong, China. [\(hal-04912207\)](#)

Hanbang Gao, Christine Chevallereau, Stéphane Caro. “Enhancing Safety in Collaborative Cable-Driven Parallel Robots: Contact Distinction and Management for Carrying Tasks.” *IEEE Transactions on Automation Science and Engineering*, vol. 22, pp. 18860-18874, 2025. [\(hal-05148888\)](#)

Ridvan Keskin, **Hanbang Gao***, Christine Chevallereau, Stéphane Caro. “Input-to-State Robustness Control for Human–Cable Interaction in Cable-Driven Parallel Robots.” *Under review*. (Submitted to European Control Conference 2026.)

Hanbang Gao, Christine Chevallereau, Stéphane Caro. “A Comprehensive Framework for Safety and Collaborative Management of Physical Human–Robot Interaction in Cable-Driven Parallel Robots.” *Under review*. (Submitted to *IEEE Transactions on Robotics*.)