



PhD Position Shaping the Geometry of Uncertainty for Data-driven Control

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Job description

Real-world systems are challenged by constantly increasing complexity and uncertainty. This uncertainty is often unknown and dynamically varying and may need to be described locally with sufficient detail. For instance, a hospital robot may seek to deliver blood samples while avoiding potential collisions with humans in the corridors by tuning its velocity in the safest possible way. In traditional approaches, such decisions are taken using a probability distribution of the uncertainty. This has the drawback of working with the single distribution that is assumed, which may even need to be chosen in an arbitrary way.

The goal of this PhD project is to build ambiguity sets of probability distributions that hedge against plausible variations of stochastic uncertainty models. It will optimize the geometry of these ambiguity sets to prevent their potential conservativeness and track their time evolution in dynamic scenarios. Particular emphasis will be devoted to data-driven formulations and on how to infer the unknown uncertainty models across sub-regions of interest while retaining formal statistical guarantees. Thereafter, the developed methods will be exploited to design efficient control algorithms for the safe deployment of autonomous systems in uncertain environments.

The approach will combine techniques across applied mathematics and control engineering and include tools from dynamical systems, optimization, uncertainty quantification, optimal transport, and high-dimensional probability. The broader aim of the project is to derive inference methods and decision algorithms that rigorously address fundamental questions in uncertainty quantification and optimal control and apply them to domains like robotics and energy systems.

Requirements

The ideal candidate has an MSc degree in systems and control, applied mathematics, mechanical or electrical engineering, computer science, or a closely related field, and a strong background in mathematics. Further familiarity with topics like optimal control, optimization, axiomatic probability theory, and real analysis is an asset. The candidate is expected to perform interdisciplinary research across control theory, uncertainty

quantification, statistics, and optimization. A good command of the English language is required.

Doing a PhD at TU Delft requires English proficiency at a certain level to ensure that the candidate is able to communicate and interact well, participate in English-taught Doctoral Education courses, and write scientific articles and a final thesis. For more details please check the [Graduate Schools Admission Requirements](#).

Conditions of employment

Doctoral candidates will be offered a 4-year period of employment in principle, but in the form of 2 employment contracts. An initial 1,5 year contract with an official go/no go progress assessment within 15 months. Followed by an additional contract for the remaining 2,5 years assuming everything goes well and performance requirements are met.

Salary and benefits are in accordance with the Collective Labour Agreement for Dutch Universities, increasing from € 2770 per month in the first year to € 3539 in the fourth year. As a PhD candidate you will be enrolled in the TU Delft Graduate School. The TU Delft Graduate School provides an inspiring research environment with an excellent team of supervisors, academic staff and a mentor. The Doctoral Education Programme is aimed at developing your transferable, discipline-related and research skills.

The TU Delft offers a customisable compensation package, discounts on health insurance and sport memberships, and a monthly work costs contribution. Flexible work schedules can be arranged.

For international applicants, TU Delft has the [Coming to Delft Service](#). This service provides information for new international employees to help you prepare the relocation and to settle in the Netherlands. The Coming to Delft Service offers a [Dual Career Programme](#) for partners and they organise events to expand your (social) network.

TU Delft (Delft University of Technology)

Delft University of Technology is built on strong foundations. As creators of the world-famous Dutch waterworks and pioneers in biotech, TU Delft is a top international university combining science, engineering and design. It delivers world class results in education, research and innovation to address challenges in the areas of energy, climate, mobility, health and digital society. For generations, our engineers have proven to be entrepreneurial problem-solvers, both in business and in a social context.

At TU Delft we embrace diversity as one of our core [values](#) and we actively [engage](#) to be a university where you feel at home and can flourish. We value different perspectives and qualities. We believe this makes our work more innovative, the TU Delft community more vibrant and the world more just. Together, we imagine, invent and create solutions using technology to have a positive impact on a global scale. That is why we invite you to apply. Your application will receive fair consideration.

Challenge. Change. Impact!

Faculty Mechanical, Maritime and Materials Engineering

From chip to ship. From machine to human being. From idea to solution. Driven by a deep-rooted desire to understand our environment and discover its underlying mechanisms, research and education at the 3mE faculty focusses on fundamental understanding, design, production including application and product improvement, materials, processes and (mechanical) systems.

3mE is a dynamic and innovative faculty with high-tech lab facilities and international reach. It's a large faculty but also versatile, so we can often make unique connections by combining different disciplines. This is reflected in 3mE's outstanding, state-of-the-art education, which trains students to become responsible and socially engaged engineers and scientists. We translate our knowledge and insights into solutions to societal issues, contributing to a sustainable society and to the development of prosperity and well-being. That is what unites us in pioneering research, inspiring education and (inter)national cooperation.

Click [here](#) to go to the website of the Faculty of Mechanical, Maritime and Materials Engineering. Do you want to experience working at our faculty? These [videos](#) will introduce you to some of our researchers and their work.

Additional information

For more information about this vacancy please contact Dimitris Boskos, Assistant Professor DCSC, email: D.Boskos@tudelft.nl.

Application procedure

Are you interested in this vacancy? Please apply by 15 October 2023 via the application button and upload:

1. a letter of motivation (max two pages),
2. a detailed Curriculum Vitae,
3. contact details of two professional referees,
4. a list of courses with grades from your BSc and MSc program,
5. a summary of your MSc thesis, and
6. a list of publications (if any).

For information about the application procedure, please contact Ms. Linda Ruijters, HR Advisor, email: recruitment-3me@tudelft.nl

Please note:

- A pre-employment screening can be part of the selection procedure.
- You can apply online. We will not process applications sent by email and/or post.
- Please do not contact us for unsolicited services.

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