



# PhD Position Probabilistic Anomaly and Fault Detection for Online Monitoring in Data-Driven Resilient Control

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## Job description

This PhD project is part of the DIGITAL TWIN Perspectief Program funded by the Dutch Research Council (NWO) that brings together researchers and organizations from six Dutch universities and seven industrial stakeholders that represent the complete value chain from different industrial sectors (high-tech systems, metal and composite materials) covering model-based design, production, product monitoring and maintenance, along with five knowledge partners that develop and deploy key technologies for high-tech companies.

The goal of DIGITAL TWIN is to enable full digitization of the value chain of high-tech systems and achieve flexible manufacturing systems along with accurate predictive maintenance, by creating a synergy between model-based engineering and data-driven learning approaches. This will be realized by developing reliable and agile digital twins of the industrial processes that enable data analytics with performance and safety guarantees to be used for real-time decision-making.

In addition to developing and testing research methodology and algorithms, the successful candidates will be involved in the interaction with representatives of various industries and stakeholders, and eventual implementation tasks on industrial demonstrators and use cases.

In this PhD project we will develop reconfigurable and self-tuning control systems by integrating system health-monitoring and real-time decision making using both model-based and data-driven approaches in a probabilistically robust framework. A set-based probabilistic approach to optimal fault detection will be pursued using non-convex scenario optimization (combining models and data). This will form the basis for a stochastic moving horizon fault estimator that can be integrated in online optimization-based, reconfigurable controllers in composite manufacturing processes, robotic manipulators, and other high-tech systems and manufacturing applications.

The [department Delft Center for Systems and Control \(DCSC\)](#) of the faculty Mechanical, Maritime and Materials Engineering, coordinates the education and research activities in systems and control at Delft University of Technology. The Centers' research mission is to conduct fundamental research in systems dynamics and

control, involving dynamic modelling, advanced control theory, optimisation and signal analysis. The research is motivated by advanced technology development in physical imaging systems, renewable energy, robotics and transportation systems.

## Requirements

Candidates for these challenging projects should have an MSc degree and background in e.g., systems and control, computer science, applied mathematics, electrical engineering, mechanical engineering, or chemical engineering. The candidate must be enthusiastic and greatly interested in fundamental research in addition to having good programming skills for implementing state-of-the-art advanced algorithms. Familiarity or previous experience with the following topics is a plus: model predictive control, model-based and data-driven fault detection and identification, reconfigurable control, moving horizon estimation, convex optimization, randomized algorithms, stochastic programming. In addition, excellent communication skills are important for this position and a good command of the English language is required.

We offer the opportunity to perform scientifically challenging research in a multi-disciplinary research group in collaboration with several key industrial partners in high-tech manufacturing. The appointment will be for up to 4 years. The PhD student will also be able to participate in the research school [DISC](#).

## Conditions of employment

TU Delft offers PhD-candidates a 4-year contract, with an official go/no go progress assessment after one year. Salary and benefits are in accordance with the Collective Labour Agreement for Dutch Universities, increasing from € 2395 per month in the first year to € 3061 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 we offer the Coming to Delft Service and Partner Career Advice to assist you with your relocation.

## 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 and aim to be as inclusive as possible (see our [Code of](#)

[Conduct](#)). Together, we imagine, invent and create solutions using technology to have a positive impact on a global scale.

Challenge. Change. Impact!

## Faculty Mechanical, Maritime and Materials Engineering

The Faculty of 3mE carries out pioneering research, leading to new fundamental insights and challenging applications in the field of mechanical engineering. From large-scale energy storage, medical instruments, control technology and robotics to smart materials, nanoscale structures and autonomous ships. The foundations and results of this research are reflected in outstanding, contemporary education, inspiring students and PhD candidates to become socially engaged and responsible engineers and scientists. The faculty of 3mE is a dynamic and innovative faculty with an international scope and high-tech lab facilities. Research and education focus on the design, manufacture, application and modification of products, materials, processes and mechanical devices, contributing to the development and growth of a sustainable society, as well as prosperity and welfare.

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? This [video](#) will introduce you to some of our researchers and their work.

### Additional information

For more information about this vacancy, please contact Prof.dr. Tamás Keviczky, email: [T.Keviczky@tudelft.nl](mailto:T.Keviczky@tudelft.nl), +31 (0)15 2782928 or Dr. Peyman Mohajerin Esfahani, email: [P.MohajerinEsfahani@tudelft.nl](mailto:P.MohajerinEsfahani@tudelft.nl).

For information about the application procedure, please contact Irina Bruckner, HR Advisor, [application-3me@tudelft.nl](mailto:application-3me@tudelft.nl).

### Application procedure

Are you interested in this vacancy? Please apply by January 31, 2022 via the application button and upload:

your detailed Curriculum Vitae, the names of two professional referees, a list of courses taken with grades obtained in your BSc and MSc program, a list of publications (if any), a summary of your MSc thesis, and a cover letter stating your motivation.

General information is also available on the [website](#).

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.

Acquisition in response to this vacancy is not appreciated.

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