

PhD Position Optimal Train Trajectory Coordination Under Uncertainty

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Company: Delft University of Technology (TU Delft)

Location: Delft

Category: computer-and-mathematical

The ever-increasing demand for travel requires transport systems to offer more capacity. One approach is to maximize the utilization of existing infrastructure to run vehicles as closely as possible, thereby enabling the operation of more vehicles. However, this presents challenges in accurately defining the varying minimum safe distances between vehicles at different locations and optimally coordinating the trajectories of multiple vehicles over the infrastructure to ensure conflict-free operations. The uncertainty in operations, such as unexpected traffic disturbances, further complicates the task of designing a trajectory coordination plan that can maintain feasibility under varying conditions.

In this research, you will focus on the optimal trajectory coordination of railway vehicles, revolutionizing railway systems through high-performance operations, reducing time intervals from minutes to seconds. You will develop mathematical models to optimally coordinate train trajectories at critical points in dense railway networks. In particular, you will analyse and characterize different types of critical points, and develop multi-train trajectory optimization models and solution methods, considering uncertainty in train operations. You will work closely with Netherlands Railways (NS), who will provide real-world data, including realized train trajectories from past operations. You will apply the developed methodology to case studies from the Netherlands Railways and provide guidelines to improve train timetabling.

The PhD research falls within the topic of railway transport planning and operations, and builds on state-of-the-art research on train timetabling and energy-efficient train operation. You will typically be using methods from operations research, optimal control, stochastic optimization and reinforcement learning.

You will work within the at Delft University of Technology, and will be supervised by Rob Goverde and Yongqiu Zhu. The Department of Transport and Planning is part of the Faculty of Civil Engineering and Geosciences at TU Delft. In the past 30 years, the department has grown into a world-leading centre for transport science and engineering, providing top-level education and world-class scientific research. The Department is organized in collaborative research labs, including the Digital Rail Traffic Lab. The Digital Rail Traffic Lab develops innovative concepts, models and methods for resilient railway transport systems that improve performance, capacity, safety and sustainability. The project is financed and executed in close cooperation with Netherlands Railways (NS). You will also work in the Department PI of Netherlands Railways for one day per week.

Specifications

36—40 hours per week

€2770—€3539 per month

Delft

Delft University of Technology (TU Delft)

Requirements

We are looking for a PhD candidate with strong mathematical skills and passion for railways.

An MSc degree in Transport, Operations Research, Applied Mathematics, Computer Science, Industrial Engineering, or related fields.

Demonstrable competence in mathematical modelling (including but not limited to optimization, reinforcement learning, and data-driven decision making).

Good programming and scientific writing skills, with the willingness to develop them further.

Enthusiasm for scientific research in close cooperation with practice.

Passion for passenger railway transport is a plus.

Good communication skills in English, both written and oral.

Mastering the Dutch language is an advantage, but not necessary.

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 .

Conditions of employment

Fixed-termcontract: 4 years.

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 a monthly work costs contribution. Flexible work schedules can be arranged.

For international applicants, TU Delft has the . 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 for partners and they organise events to expand your (social) network.

Employer

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 and we actively 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!

Department

Faculty Civil Engineering & Geosciences

The Faculty of Civil Engineering & Geosciences (CEG) is committed to outstanding international research and education in the field of civil engineering, applied earth sciences, traffic and transport, water technology, and delta technology. Our research feeds into our educational programmes and covers societal challenges such as climate change, energy transition, resource availability, urbanisation and clean water. Our research projects are conducted in close cooperation with a wide range of research institutions. CEG is convinced of the importance of open science and supports its scientists in integrating open science in their research practice. The Faculty of CEG comprises 28 research groups in the following seven departments: Materials Mechanics Management & Design, Engineering Structures, Geoscience and Engineering, Geoscience and Remote Sensing, Transport & Planning, Hydraulic Engineering and Water Management.

Click to go to the website of the Faculty of Civil Engineering & Geosciences.

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