A survey of intelligent driver machine interfaces in transportation cockpits

Alstom

Select one (or more) categories to which this degree project corresponds the best

- ☐ Traffic Planning, market and Simulation
- ☒ Signalling and Traffic control systems
- ☐ Vehicles for Rail and Public transport
- ☐ Rail track, Geotechnics and Constructions
- ☐ Properties and Land use
- ☐ Electrical engineering and Power supply
- ☐ Digitalization, AI and Data Analytics
- ☐ Business Management
- ☐ Sustainability and Environment
- ☐ Other

Background

Being Europe's largest train manufacturer and railway system provider, Alstom always explores cutting-edge technologies to provide safer and more efficient interactions between the driver and the train. One of the most important interfaces is the driver desk including various controls and displays in the train's cockpit. We work on the next generation "smarter" Human/Driver Machine Interfaces (HMI/DMI), with the help of artificial intelligence.

Problem description, tasks, and goals

Recent years have witnessed a booming application of artificial intelligence in the cockpits of all transportation modes, especially automotive. Various AI-based features have been developed and deployed in rich application scenarios with benefits demonstrated, not only to the safe and efficient driving tasks, but also reliability, availability and maintainability of the HMI devices. This thesis aims to investigate the application of AI technology in the driver's cab focusing on the interaction through the human machine interface. The goal is to understand the benefits and limitations of various AI-based solutions in the different transportation modes, and explore the applicabilities to railway.
The student is expected to:
1. Perform a comprehensive survey on the AI based solutions for driver machine interfaces of the following sectors: railway, automotive (including heavy vehicles), aviation, maritime.
2. Categorize the technologies used behind the solutions, and explain the strengths, limitations and benefits.
3. Applicability study of the surveyed solutions and technologies to railway. This may involve interviews with railway HMI experts and/or train drivers.The student will be introduced to the driver machine interface of the trains.The thesis can be either a bachelor or a master thesis, which differ in depth and scope.Prerequisites: Background in software engineering, embedded systems, computer science, human computer interaction, or another related field. Knowledge of artificial intelligence is mandatory. Well-organized, good at reading and writing, good communication skills.

Type of degree project (can be both)

- ☒ Master (20 weeks)
- ☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis

☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

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Automated analysis of free text fault and repair reports

Alstom

Select one (or more) categories to which this degree project corresponds the best

- ☐ Traffic Planning, market and Simulation
- ☒ Signalling and Traffic control systems
- ☐ Vehicles for Rail and Public transport
- ☐ Rail track, Geotechnics and Constructions
- ☐ Properties and Land use
- ☐ Electrical engineering and Power supply
- ☐ Digitalization, AI and Data Analytics
- ☐ Business Management
- ☐ Sustainability and Environment
- ☐ Other

Background
Alstom's Train Control and Communication (TC&C) Platform includes hundreds of products that are used in several train platforms. We provide products in all categories from drivers displays to control computers and networking to connect these in a real time onboard network. These products can fail both from the point of hardware but also in terms of software. In both cases, these products may be either managed internally or provided by suppliers external to Alstom. What we see is that we have two cases where we could automate an understanding of the impact on the product and what to focus on in terms of making our products more reliable, the fault report and the repair report.

Problem description, tasks, and goals
The thesis project will focus on exploring and assessing different state-of-the-art strategies such as different LLM models, to better connect fault reports to the resulting repair reports, along with enough data to understand what areas should be addressed to increase the overall reliability and availability of the product. These reports, change requests and other documentation are mostly free text. Selected strategies will then be developed on a conceptual level for the data available in the TC&C Platform, analyzed and evaluated providing recommendations on a process and architecture for such an automated system. Overall, the goal can be described as:
1. Introduction to train control and communication platform, including relevant products for the scope.
2. Introduction to Alstom's processes including fault reports, repair reports, change requests, and configuration management.
3. Survey of state-of-the-art research in automated text analysis.
4. Definition of assessment criteria.
5. Assessment and selection of preferred solutions and strategies.
6. Concept development.
7. Evaluation.
8. Analysis, conclusions, and reporting.

The scope of the project can be adapted to suit one or two thesis students.
Prerequisites: Background in software engineering, artificial intelligence / machine learning state of the art including LLM. A familiarity with hardware and mechanical and electrical engineering is beneficial. Good analytical skills and systems thinking mindset.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

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CFD based methods to generate thermal digital twins railway traction converters

Alstom

Select one (or more) categories to which this degree project corresponds the best

- ☐ Traffic Planning, market and Simulation
- ☐ Signalling and Traffic control systems
- ☐ Vehicles for Rail and Public transport
- ☒ Rail track, Geotechnics and Constructions
- ☐ Properties and Land use
- ☐ Electrical engineering and Power supply
- ☐ Digitalization, AI and Data Analytics
- ☐ Business Management
- ☐ Sustainability and Environment
- ☐ Other

Background

Alstom's latest traction platform is designed to deliver very high performance density. This is accomplished by the effective utilization of the latest generation of power semiconductor devices in a new standardized and scalable packaging for railway traction. Simulations are used to effectively utilize this performance potential, where accurate thermal models are critical. However the models need to combine high fidelity with light computational loads and short processing time.

Problem description, tasks, and goals

The thesis project will focus on developing and validating procedures to derive Reduced Order Models from CFD simulations for a given product design from which machine learning based digital twins can be generated for use in performance simulations. The following steps are foreseen:

1. Introduction to electric railway traction design
2. Introduction to Alstom's modular traction platform thermal design and mission profiles
3. Introduction to Alstom CFD tools
4. Survey of state of the art research and tools in CFD modeling methods for digital twins
5. Model development for Alstom product
6. Evaluation of model accuracy
7. Development and evaluation of an optimum workflow
8. Analysis, conclusions and reporting

The scope of the project can be adapted to suit one or two thesis students.

Prerequisites: Background in thermo- / aerodynamics including a proficiency in CFD tools along with an understanding of electrical and mechanical engineering. Good analytical skills and systems thinking mindset.

Type of degree project (can be both)

- ☒ Master (20 weeks)
- ☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis

☒ Swedish and/or ☒ English

Is Swedish a language requirement?

☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

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Compact digital twin virtual sensor for edge computing in railway traction controller

Alstom

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☒ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
Alstom's latest traction platform is based on high performance converters operated with advanced control methods in Alstom's indigenous control platform. The control platform uses several sophisticated control algorithms that require high fidelity real time monitoring while limiting the need for discrete hardware sensors

Problem description, tasks, and goals
The thesis project will focus on developing, implementing and validating a virtual thermal sensor for a railway traction converter created from a machine learning based digital twin. The model needs to be compact, provide high accuracy with low processor loads. The following steps are foreseen:
1. Introduction to electric railway traction design
2. Introduction to Alstom's traction control platform
3. Survey of state of the art research on virtual sensors and compact digital twins
4. Digital twin development for Alstom product based on data from reduced order CFD models
5. Implementation on target device
6. Evaluation of model accuracy and processor performance including risk assessments
7. Development and evaluation of an optimum workflow
8. Analysis, conclusions and reporting

The scope of the project can be adapted to suit one or two thesis students.
Prerequisites: Background in data science, machine learning and AI with an understanding of electrical and control engineering. Good analytical skills and systems thinking mindset.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

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Condition monitoring and fault detection by GDU based smart sensor functions

Alstom

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☒ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
Alstom's new traction platform is designed to deliver high performance and energy density. This is accomplished by the effective utilization of the latest generation of power semiconductor devices (Si / SiC) in a new standardized and scalable packaging for railway traction. Alstom's state of the art Gate Drive Unit (GDU) - technology is developed for controlling the semiconductor modules optimally based on different operating conditions. The GDU FPGA is integrated with advanced sensing capabilities which can not only sense base parameters like voltage, current, temperature but can also incorporate new features for condition monitoring and fault detection.

Problem description, tasks, and goals
In the real-world traction application, semiconductor failures are not uncommon, even though the new generation of power semiconductor devices are designed to last for several years of hard operation. Understanding and mitigating these failure scenarios is critical for a successful traction converter business. The thesis project will focus on exploring different failure modes in new generations of IGBTs / MOSFETs, especially in Alstom field applications and develop suitable detection & mitigation functions in the GDU FPGA for minimizing the impact of these failures. Moreover, the work includes a survey of typical failures modes and semiconductor condition monitoring in general so that the best strategies can be adapted for Alstom applications. An assessment will be made based on the literature survey and field experience on order to short list the most critical failure modes to be mitigated first. A corresponding detection and mitigation strategy will be selected for implementation after careful review by the expert team. Selected strategies will then be developed in the GDU FPGA firmware and will be tested and evaluated in the IGBT lab. Successfully evaluated functionalities will become part of the future GDU product upgrade.

The work includes (but not limited to)

- Introduction to Alstom's IGBT/GDU team and way of working in Västerås
- Introduction to electric railway traction converter and gate drive techniques

- Survey of semiconductor failure modes in traction applications and strategies for detection and mitigation
- Study Return of Experience (REX) from Alstrom applications
- Assessment and selection of failure modes and mitigation strategies to work on
- Concept development
- FW development, test and evaluation with the help from the team
- Analysis, conclusions and reporting

Prerequisites: Background in electrical, electronics and/or computer engineering, basic understanding of power electronics and semiconductor switches. Knowledge VHDL is a plus but not mandatory. Good analytical skills.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

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Characterization of inductors for sound prediction on trains

Alstom

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
Alstom has identified a need to improve the sound environment on trains by predicting the sound from inductors and transformers in converters. It has proven difficult to obtain useful results through the simulation of electromagnetism - structure and airborne sound. Therefore, a thesis is proposed to characterize inductors and find significant common denominators that affect sound radiation.

Problem description, tasks, and goals
The goal of the thesis is to develop a method for predicting sound from inductors on trains. To achieve this, a number of inductors will be measured and analyzed through modal analysis and sound measurement. The results will be used to identify factors that affect the sound and propose a method for sound prediction

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

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Ethernet receiver for measurement data

Alstom

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☒ Other

Background

In power lab and in train testing we are using DCUtermplugin. This is used to stream data from all of our control systems in the trains through DCUterm and present/record this data in Dewesoft.

Problem description, tasks, and goals

The DCUterm plugin has a slow sample rate and limited interface flexibility as well as no possibility for time synchronization. Goal is to use the standard Ethernet receiver function in dewesoft

Goals:

Prio 1

•Define target IP address (PC with interface to DCUterm or preferable direct to the control computer.

•Select signals

•Define signals quantities from a lock up table

•Record data at 4 ms task time

•Mitrac tools source systems

Prio 2

•Record DSP data at 100 us task time

•Time synchronization

•AC4 source systems

Prerequisites: Skilled in IP communication areas.

Type of degree project (can be both)
☒ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact persons

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Instrument register

Alstom

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☒ Other

Background

In power lab we have a large number of instruments and other test components. This is manually handled in terms of booking, in/out, repairs and calibration . The interface needs to interact with an external database in a company based in Västerås called Intertek.

Problem description, tasks, and goals

Define a database with the possibility to use the bar codes for all above steps.

Goals:

Prio 1

- Instrumentation In/out of storage area with information on responsible person and location as well as time
- Booking system of instruments

Prio 2

- Components in warehouse , for example fans, magnetical components, motors shall also be defined with Bar codes and be handled in a similar way but only in an local Alstom database

Prerequisites: Skilled in IP communication areas.

Type of degree project (can be both)

☐ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis

☐ Swedish and/or ☒ English

Is Swedish a language requirement?

☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Possibility to work from our office

☒ Yes ☐ No

Contact persons

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Resp. manager: Patrik Ericsson
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Wear particle emissions from mechanical brakes on freight trains

Green Cargo AB

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☒ Sustainability and Environment
☐ Other

Background
Emission of airborne particles during the braking is significant aspect of the railway brake system. The particles emitted by train are found to contain a substantial proportion of metals such as Fe, Cu and Mn. These redox active metals make the train emitted particles eight times more genotoxic than ambient particles. Unlike the brake wear emissions from automotive vehicles, which are recently regulated in the newest European emission standard Euro 7. Brake particle emissions from railway vehicles have been very poorly researched, and the exact contribution of the train brake system to the total particle emissions from railway vehicles remains unclear.

About the company
Green Cargo is a sustainable logistics partner and an important part of Scandinavian business life. Almost 98 percent of our transport work takes place with electric trains with a very low climate impact. Every weekday, we run 400 freight trains and replace around 9,000 truck transports on the road network every day. In our network, we serve nearly 300 locations in Sweden, Norway and Denmark, and with partners we reach the whole of Europe. We have 1,800 employees, transport approximately 20 million tonnes of goods and have an annual turnover of SEK 4.2 billion (2023).

Problem description, tasks, and goals
Braking materials will be evaluated by lab experiments for normal and emergency braking. Goals: 1) To study the friction, wear and particle emission (number and mass concentration and size distribution) from various brake block and brake disc materials used on freight trains. 2) To characterize the chemical composition and microstructure of the emitted particles and estimate its environmental and health impacts

Type of degree project (can be both)
☒ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact person

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Performance comparison between disc brakes and tread brakes for railway wagons

Green Cargo AB

Select one (or more) categories to which this degree project corresponds the best

- ☐ Traffic Planning, market and Simulation
- ☐ Signalling and Traffic control systems
- ☒ Vehicles for Rail and Public transport
- ☐ Rail track, Geotechnics and Constructions
- ☐ Properties and Land use
- ☐ Electrical engineering and Power supply
- ☐ Digitalization, AI and Data Analytics
- ☐ Business Management
- ☐ Sustainability and Environment
- ☐ Other

Background
Tread brakes is most commonly used braking system on wagons. Further, a variety of brake block materials can be used on these wagons depending on the operating conditions. These material are: cast iron, organic composite and sinter material. In heavy haul or high-speed freight trains, use of wagons with disc brakes is increasing. In addition, winter conditions might reduce the life of wheels in tread braking even further. There are trainsets that use wagons with tread brakes and wagons with disc brakes. Such trainsets can be utilized to make a direct comparison on performance between tread brakes and disc brakes.

About the company
Green Cargo is a sustainable logistics partner and an important part of Scandinavian business life. Almost 98 percent of our transport work takes place with electric trains with a very low climate impact. Every weekday, we run 400 freight trains and replace around 9,000 truck transports on the road network every day. In our network, we serve nearly 300 locations in Sweden, Norway and Denmark, and with partners we reach the whole of Europe. We have 1,800 employees, transport approximately 20 million tonnes of goods and have an annual turnover of SEK 4.2 billion (2023).

Problem description, tasks, and goals
Life cycle costs for wagons are influenced by wheels and brake discs. This study can provide strong basis for deciding the utilization of wagons with optimal braking system to be used in trainsets. Goals: 1) To compare the wear data for wheels and discs 2) To study the types of damage that reduces the life of wheels and discs

Type of degree project (can be both)
- ☒ Master (20 weeks)
- ☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact person

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Develop a Door Computer for Train Coaches

SJ AB

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☒ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☒ Other

Background
As vehicles are getting older the technology used is slowly outdated and spare parts are not any longer possible to buy or produce. An example of this is the PLC computer containing all the intelligence and functionality for steering of the doors in the passenger coaches. SJ needs a new computer to be able to keep the coaches in traffic in the future.

Problem description, tasks, and goals
Pre-study: Analyse the current computer technology and the functionalities that it provides. Technical solution: Find an existing PLC computer that is railway compatible according to all regulations with safety integrity level 3 or above. Write code for the new PLC computer that fulfils today's railway requirements and adds the possibility to communicate with new train monitoring system for passenger coaches. The aim of monitoring the signals is to increase reliability, availability, and maintainability of the door systems. The doors are crucial for passenger safety and therefor much effort must be put on safety matters. A new computer with code must be able to replace the old computer to full extent. Final report: A written technical report and a presentation of the findings to involved roles and functions at SJ. The report should describe the technical solution and a recommendation on how to implement it.

Type of degree project (can be both)
☒ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact person
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Image Recognition in Material Management

SJ AB

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☒ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
In the railway industry, traceability requirements are high, and it is critical that the correct material is installed on the trains and that this is correctly reported in the system. Each type of material has an individual number of 6-8 digits, which is also used to check inventory balance. There are over 5000 items in the inventory. Today, it is difficult to easily and efficiently search for materials in the maintenance system. There are many similar items, and a train technician may need to spend a lot of time identifying and retrieving replacement materials. There is also a risk for retrieving the wrong material or that the material withdrawal is incorrectly reported. A possible aid that could simplify handling is image recognition of different components and spare parts.

Problem description, tasks, and goals
The tasks may include all or parts of the following: Identify techniques and develop methods for image recognition of components and spare parts; develop hardware and software to identify which material and material numbers are removed from the vehicle through image recognition; write a well-structured report describing the method and results, enabling further work. The final scope and problem formulation will be developed jointly between SJ, the student, and the supervisor at the university.

Type of degree project (can be both)
☒ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact person
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Method for Noise Mapping in Train Depots

SJ AB

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☒ Sustainability and Environment
☒ Other

Background
SJ has a need to better describe and understand how our trains and operations contribute to noise levels in and around the depots in use. The focus is on our largest depot in Hagalund, Solna. Residents around the Hagalund depot complain about noise, but it is difficult to identify which part of the operation and which trains are contributing to the noise levels. SJ wants to be able to map the noise with the aim of describing how its own operations and the various vehicles contribute to the noise levels - both in Hagalund and in other places where the need may arise. The goal is to both quantify the noise contribution from the vehicles and operations and also identify effective noise-reducing measures that can be implemented without negatively affecting the rest of the depot operations.

Problem description, tasks, and goals
The tasks may include all or parts of the following: Literature study and review of previously performed work; developing of a method to measure and map noise in Hagalund depot and other places; perform measurements of noise in Hagalund depot; identify how SJ's trains and operations contribute to the noise in Hagalund; develop a general model for noise analysis; identification of effective noise-reducing measures; well-written report describing the method and results, enabling further work. Proficiency in Swedish is necessary to read SJ documentation.

Type of degree project (can be both)
☒ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☐ English

Is Swedish a language requirement?
☒ Yes ☐ No ☐ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

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Assignments in rail

SL Region Stockholm

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☒ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☒ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☒ Electrical engineering and Power supply
☒ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
The assignments for rail traffic are in the following areas: Traffic, Operation and maintenance, Organization and processes, Technology in traffic control and signalling.

Problem description, tasks, and goals
The purpose of all different master thesis that deal with orientation and choice of technology for systems and working methods for rail traffic is to contribute to and ensure that both asset management and development perspectives are considered currently in this moment and in the future.

Type of degree project (can be both)
☒ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

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Team Student about practical things like application and assignment as well as guidance into the organization to discuss mutual interest in different areas and work ideas.

Thesis proposals will also be published here: https://www.regionstockholm.se/jobb/for-dig-som-letar-jobb/lediga-jobb/?query=exjobb&orderBy=Relevance&categories=&organizations=Trafikf%C3%B6rvaltningen&placements=&employmentScopes=&skip=0&take=20

JBS JÄRNVÄGSBRANSCHENS SAMVERKANSFORUM

Effective risk management in the design phase of railway projects

SWECO – Transport, Railway

Background

Sweco plans and designs the sustainable communities and cities of the future. Together with our clients, our team of 18,000 architects, engineers, and other specialists develops solutions to address urbanization, leverage the opportunities of digitalization, and make future societies more sustainable. Sweco is the leading consulting firm in technology and architecture in Europe, with a revenue of approximately 22 billion SEK. The company is listed on Nasdaq Stockholm. For further information, please visit www.sweco.se. Within the Transport Infrastructure division, we work on everything from small-scale initiatives to mega-projects in infrastructure. Admittedly, and with a hint of bias, we believe our projects—particularly due to their multifaceted nature—are among the most enjoyable, challenging, and stimulating endeavors at Sweco. However, we recognize that aspects of our project management processes can always be developed and improved, which is where this thesis comes into play. The purpose of the thesis is to develop and enhance our methodologies.

Question

How can risk management in the design phase be improved to minimize cost increases and delays in large railway projects? This question can explore how risk management is identified, assessed, and managed in the early phases to avoid problems later in the project

Type of degree project (can be both)

Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis

Swedish:☒ and/or English:☒

Is Swedish a language requirement?

Yes:☐
No: ☐
No, but Swedish is a requirement for future employment:☒

Possibility to work from our office

Yes:☒
No:☐

Contact person

Agneta Innergård — Group Manager, Project Management, Transport Infrastructure
agneta.innergard@sweco.se

Martin Hjort — Group Manager, Project Management, Transport Infrastructure
martin.hjort@sweco.se

Are you two proactive and engaged students eager to contribute to the development and optimization of our project organizations? Are you interested in large-scale projects and intrigued by the possibility of investigating how we can refine our working methods? If so, you have the opportunity to do so with us!

Writing your thesis at Sweco allows you to experience what it is like to work here and become part of Sweco's culture. For us, your thesis represents an excellent opportunity to begin getting to know you and to learn more about your ideas, skills, and perspectives. A well-executed thesis may lead to an employment offer.Sweco engages in innovative projects that are often incredibly exciting from multiple perspectives. We are not confined to a specific issue but are keen to collaboratively identify this with you.

JBS JÄRNVÄGSBRANSCHENS SAMVERKANSFORUM

Coordination and communication between different disciplines in complex infrastructure projects

SWECO – Transport, Railway

Background

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Question

How can coordination and communication between different technical disciplines (e.g., signaling technology, geotechnics, and architecture) be improved to reduce the number of design conflicts in the design phase of large railway projects?

Type of degree project (can be both)

Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis

Swedish:☒ and/or English:☒

Is Swedish a language requirement?

Yes:☐
No: ☐
No, but Swedish is a requirement for future employment:☒

Possibility to work from our office

Yes:☒
No:☐

Contact person

Agneta Innergård
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Group Manager, Project Management, Transport Infrastructure

Martin Hjort
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Group Manager, Project Management, Transport Infrastructure

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Cost control in large infrastructure projects during the design phase

SWECO – Transport, Railway

Background

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Question

What methods and tools can be used to improve cost control during the design phase in large railway and subway projects?

Type of degree project (can be both)

Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis

Swedish:☒ and/or English:☒

Is Swedish a language requirement?

Yes:☐
No: ☐
No, but Swedish is a requirement for future employment:☒

Possibility to work from our office

Yes:☒
No:☐

Contact person

Agneta Innergård
agneta.innergard@sweco.se
Group Manager, Project Management, Transport Infrastructure

Martin Hjort
martin.hjort@sweco.se
Group Manager, Project Management, Transport Infrastructure

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JBS JÄRNVÄGSBRANSCHENS SAMVERKANSFORUM

Improved scheduling and time tracking during the design phase

SWECO – Transport, Railway

Background

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Question

How can time tracking and scheduling be improved during the design phase in large infrastructure projects to ensure that the projects adhere to their timelines?

Type of degree project (can be both)

Master (20 weeks): ☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis

Swedish: ☒ and/or English: ☒

Is Swedish a language requirement?

Yes: ☐
No: ☐
No, but Swedish is a requirement for future employment: ☒

Possibility to work from our office

Yes: ☒
No: ☐

Contact person

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Martin Hjort
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The importance of leadership for the performance of the project team during the design phase

SWECO – Transport, Railway

Background

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Question

How do different leadership styles affect the performance and collaboration of the team during the design phase of complex subway and railway projects?

Type of degree project (can be both)

Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis

Swedish:☒ and/or English:☒

Is Swedish a language requirement?

Yes:☐
No: ☐
No, but Swedish is a requirement for future employment:☒

Possibility to work from our office

Yes:☒
No:☐

Contact person

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JBS JÄRNVÄGSBRANSCHENS SAMVERKANSFORUM

Use of agile project management in the design phase of large railway projects

SWECO – Transport, Railway

Background

Sweco plans and designs the sustainable communities and cities of the future. Together with our clients, our team of 18,000 architects, engineers, and other specialists develops solutions to address urbanization, leverage the opportunities of digitalization, and make future societies more sustainable. Sweco is the leading consulting firm in technology and architecture in Europe, with a revenue of approximately 22 billion SEK. The company is listed on Nasdaq Stockholm. For further information, please visit www.sweco.se. Within the Transport Infrastructure division, we work on everything from small-scale initiatives to mega-projects in infrastructure. Admittedly, and with a hint of bias, we believe our projects—particularly due to their multifaceted nature—are among the most enjoyable, challenging, and stimulating endeavors at Sweco. However, we recognize that aspects of our project management processes can always be developed and improved, which is where this thesis comes into play. The purpose of the thesis is to develop and enhance our methodologies.

Question

Can agile methods be applied during the design phase of large railway and subway projects, and if so, how does it affect the project's flexibility and adaptability?

Type of degree project (can be both)

Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis

Swedish:☒ and/or English:☒

Is Swedish a language requirement?

Yes:☐
No: ☐
No, but Swedish is a requirement for future employment:☒

Possibility to work from our office

Yes:☒
No:☐

Contact person

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Group Manager, Project Management, Transport Infrastructure

Martin Hjort
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Group Manager, Project Management, Transport Infrastructure

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Factors affecting Dynamic Pricing Models for Railway Operators

Sweco Sverige AB – Tågtrafik & Logistik (Railway traffic & Logistics)

Select one (or more) categories to which this degree project corresponds the best

☒ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☒ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background

Dynamic pricing is a crucial strategy for optimizing railway operations by adjusting ticket prices based on demand fluctuations. With advancements in AI, machine learning, and real-time data processing, there is an opportunity to explore more sophisticated approaches to dynamic pricing. This project invites students to investigate how these technologies can be applied to enhance pricing models in the railway industry.

Problem description, tasks, and goals

Current dynamic pricing systems may not fully account for real-time factors such as local events, weather conditions, or customer preferences. Additionally, the potential for dynamic pricing to support sustainability goals, such as promoting off-peak travel or reducing carbon emissions, is not always explored. The challenge is to identify significant variables and patterns in data that can improve pricing strategies while aligning with both business and environmental objectives. The aim of this project is to develop and test an enhanced dynamic pricing model for railways. Students will explore advanced AI techniques, integrate data, and assess the impact of various factors on pricing decisions. To deepen their understanding, students are encouraged to conduct interviews or meetings with industry operators or customers to gather insights on key variables and perspectives. This research will help in identifying patterns and developing a more responsive and effective pricing model.

Type of degree project (can be both)

☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis

☒ Swedish and/or ☒ English

Is Swedish a language requirement?

☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office

☒ Yes ☐ No

Contact person

Albin Kvarnefalk
Capacity analysist within railway
albin.kvarnefalk@sweco.se

Enhancing Collaboration through Contract Design in Swedish Rolling Stock Maintenance

Sweco Sverige

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☒ Business Management
☐ Sustainability and Environment
☐ Other

Background
The Swedish railway system is among the most deregulated in Europe, if not the most. While this promotes competition, it also heightens the need for collaboration. Public procurement contracts are typically awarded to the lowest bidder, which often results in suboptimal outcomes as each participant concentrates solely on reducing their own costs.

Problem description, tasks, and goals
How can contracts be designed to foster collaboration in Swedish rolling stock maintenance? This project will involve reviewing current contracts, identifying essential elements that promote beneficial collaboration, and creating guidelines to enhance these aspects in future contracts. The study should discuss the potential benefits of enhanced collaboration from the perspectives of, but not limited to, innovation, cost-effectiveness, and asset management. Additionally, it will include standard research procedures, such as reviewing existing literature on the topic.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact person
Fredrik Strandberg Consultant Rolling Stock
fredrik.strandberg@sweco.se

External Power Supply for non-electrified Railways

Sweco Sverige

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☒ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
In Sweden 75% of the railway is electrified. Today the non-electrified railways are operated by locomotives with internal combustion engines running on fossil fuel. On the market today there are alternatives. However these locomotives both electrical with batteries or internal combustion engines, are not suited to supply power for other applications than propulsion itself when in combustion mode. When power supply is needed for other applications, the most common method is to use an external power pack such as an external diesel generator with a fuel tank. This is used to supply power for example construction equipment and emergency heating for passenger coaches.

Problem description, tasks, and goals
The problem is that current locomotives running on internal combustion engines is not suitable to supply external functions beyond propelling the vehicle. The task is to create a reliable energy source concept for construction and emergency operations. The concept should not be dependent on a specific locomotive or construction equipment.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact person
Karl Ståhlberg Consultant Rolling Stock
karl.stahlberg@sweco.se

Utilizing AI to Optimize Rolling Stock Maintenance Scheduling

Sweco Sverige AB

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☒ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background

Railways have long been a cornerstone of Swedish transportation infrastructure, providing an efficient and sustainable means of travel and freight movement. As the demand for rail services increases, so does the need for maintenance of rolling stock—locomotives, passenger cars, and freight wagons. Effective maintenance is crucial not only for safety and reliability but also for cost efficiency and operational performance.
Traditionally, rolling stock maintenance has been scheduled based on predefined intervals, often leading to either over-maintenance or unexpected failures. This approach can be both costly and inefficient. In recent years, there has been a growing interest in leveraging advanced technologies to optimize these maintenance schedules. Artificial Intelligence (AI) presents a promising avenue for revolutionizing maintenance strategies.

Problem description, tasks, and goals

This thesis aims to explore how artificial intelligence (AI) can be leveraged to optimize maintenance schedules for rolling stock, thereby enhancing operational efficiency, and reducing costs. The thesis should aim to understand the stakeholders involved in the maintenance process and examine how alterations to a maintenance schedule affect, and are affected by, these actors. Additionally, the thesis will involve developing an AI model for optimization of maintenance schedules.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact person
Fredrik Strandberg
Consultant Rolling Stock
fredrik.strandberg@sweco.se

Image recognition of rolling stock components during inspection

SYSTRA AB

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☒ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
One of the main problems faced by the Swedish railway industry is breakdown of rolling stock operations due to various reasons such as faulty components, changing regulations and legacy methods for asset register, and maintenance crunch amongst others. In Systra we consult for various stakeholders in the Swedish railway industry on asset management of rolling stock with an increasing push towards digitalization. Our experience places us at a unique position to cater to the future needs of the rolling stock operators to realise the maximum value from their assets

Problem description, tasks, and goals

At Systra we are exploring digital solutions to help us with predictive maintenance of rolling stock and reduce time in identifying and resolving faults in the asset. In this we envision a connected digital eco-system encompassing rolling stock-focussed activities such as inspection at different stages of asset lifecycle, operation, safety assessment, inventory management, etc. An important step in this initiative is building a robust digital inspection tool. In this you will help us with the development of one of the key product features, i.e. **image recognition of components**.

Your activities include (but not limited to)

- Develop a functioning image recognition algorithm tailored to rolling stock subsystems preferably in Python using external libraries, i.e. you are not expected to write it from scratch
- Starting from the analysis of static images, extendable to dynamic image processing
- Perform a literature survey of similar tools/technologies in use in other capital-intensive industries, e.g. energy, ports, buildings, etc
- Follow product development principles in setting requirements and defining basline scope of the product feature

Skills we look for:

- Experience in writing code in Python/MATLAB.
- Willingness to learn

- Knowledge of the rolling stock system
- First principles of systems engineering
- Meritorious to have an understanding of underlying principles such as CNN, feature extraction, object detection algorithms, etc.
- Independent & collaborative: You will need to take the initiative to engage with various people during the assignment

Type of degree project (can be both)
☒ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact person
Visakh V Krishna, PhD. Consultant – Asset management
vkrishna@systra.com

ERTMS Level 1

SYSTRA AB

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☒ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
Sverige har haft en inriktning på att välja ERTMS Level 2 när man ska byta ut sitt ATC-system till ERTMS. I andra länder har man valt en annan inriktning.

Problem description, tasks, and goals
Vad krävs för att kunna behålla befintliga signalställverk och införa ERTMS Level 1 i Sverige? Vilka skillnader finns i kapacitet mellan ERTMS Level 1 och ERTMS Level 2?

Type of degree project (can be both)
☐ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☐ English

Is Swedish a language requirement?
☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact person
Mikael Cederlund Utredare Signalteknik
mcederlund@systra.com

ERTMS Level 1

SYSTRA AB

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☒ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
Sweden have chosen to use ERTMS Level 2 when replacing their old ATP-system to ERTMS. Other countries have chosen other levels of ERTMS.

Problem description, tasks, and goals
What is needed to keep the existing interlockings and use ERTMS Level 1 in Sweden? Is the capacity reduced in an ERTMS Level 1 compared to an ERTMS Level 2-system? Are there any benefits with choosing an ERTMS Level 1-system compared to a Level 2-system?

Type of degree project (can be both)
☒ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☐ No ☒ No, but Swedish is a requirement for future employment

Possibility to work from our office
☒ Yes ☐ No

Contact person
Mikael Cederlund
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Signalling Safety Reviewer

Examensarbete inom elkraftsområdet

Vill du vara med och utveckla ett av Sveriges största och mest avancerade elkraftsystem och dessutom göra avtryck på framtidens infrastruktur? Skriv exjobb inom elkraft och bidra till hållbara transporter.

Detta är en generell annons för dig som redan har en specificerad frågeställning för examensarbetet och vill se om vi inom Elkraft är intresserade att realisera den tillsammans. Trafikverket Elkraft annonserar också specificerade examensarbeten utifrån våra egna frågeställningar. Dessa publiceras två gånger per år, tidig höst och tidig vår.

Uppdragsgivare
Trafikverket ansvarar för långsiktig planering av transportsystemet för vägtrafik, järnvägstrafik, sjöfart och luftfart samt för byggande, drift och underhåll av de statliga vägarna och järnvägarna. Trafikverket prövar också frågor om statligt bidrag till svensk sjöfartsnäring och verkar för tillgänglighet i den kollektiva persontrafiken genom bland annat upphandling av avtal.

Järnvägar
Trafikverket är infrastrukturförvaltare för cirka 14 200 spårkilometer av Sveriges järnvägsnät. Den allra största delen, över 80 procent, är elektrifierad järnväg. Utöver det statliga järnvägsnätet finns industrispår till exempel hos industrier, terminaler och hamnar, spårvägar och tunnelbanor.

Bakgrund:
Trafikverket arbetar med elkraft inom ett flertal områden. Mest känt är att vi har ett avancerat kraftsystem för att försörja elektriska tåg samt järnvägens kringutrustning. Det är ett av Sveriges största kraftnät och den sammanlagda effekten är ca 2 000 MVA.

Tågen på järnvägen matas i Sverige via ett 1-fas system med en frekvens på 16,7 Hz. Lasterna (tågen) i detta system är i ständig rörelse med varierat effektuttag. Hos Trafikverket finns omformarstationer för att omvandla elenergi med en frekvens på 50 Hz till 16,7 Hz. Detta sker både med avancerade omriktare med den senaste halvledartekniken samt med roterande omformare bestående av synkronmotorer och synkrongeneratorer. Energin förs ut till fordonen via ett nät av kontaktledningar, matarledningar, kopplingscentraler och transformatorstationer. Kontaktledningarna står i förbindelse med en strömavtagare på fordonet som via elmotorer driver tågen. För att försörja lasterna utmed järnvägen med elenergi, som t.ex. signalanläggningar, teleanläggningar, belysning på bangårdar och för att värma spårväxlar har Trafikverkets ett högspänt 50 Hz hjälpkraftssystem samt lokala kraftanslutningar med lägre spänning. Hela kraftsystemet övervakas och styrs via driftcentraler samt anläggningens egna styr- och övervakningssystem med reläskydd, regulatorer, etc.

Förutom arbete med järnväg utvecklar och förvaltar Trafikverket även vägnätets kraftförsörjning, exempelvis belysningen och kraftförsörjning av tunnlar. Dessutom arbetar vi med elektrifiering av vägar samt elektrifiering av vägfärjor och därtill kopplade system. Totalt sett spänner trafikverkets kraftsystem över ett stort antal teknikområden där vi besitter specialistkompetens.**Frågeställning**

- Hur kan kvarstående livslängd för befintliga kontaktledningsfundament i Trafikverkets anläggning bedömas på ett tillförlitligt sätt?
- Har de designförändringar som genomförts, t.ex. övergången till ihåliga fundament, haft en positiv eller negativ inverkan på fundamentens livslängd?
- Vilka åtgärder kan vidtas för att förlänga livslängden hos befintliga fundament så att de klarar Trafikverkets mål om en livslängd på uppemot 100 år, och kan förbättringar i utformningen minska riskerna för exempelvis korrosion och stående vatten i ihåliga fundament?

Om examensarbetet
Det här är en möjlighet för dig som har ett stort intresse för teknik, att tillsammans med våra tekniska specialister, fördjupa dig inom elkraftsområdet.

Arbetet utförs individuellt eller i par om två studenter. Studenterna själva driver arbetet framåt och har löpande avstämningar med personal från Trafikverket samt högskolan eller universitetet.

Examensarbetet bygger på en av studenten framtagen frågeställning som sedan planeras och utformats tillsammans mellan Trafikverket och lärosätet utifrån behov, kunskap och intresseområde. Det är också

viktigt att säkerställa att kravet kring arbetets formella utformning uppfylls. Ofta inleds arbetet med en litteraturstudie med tillhörande inläsningsfas innan själva uppgiften eller forskningsområdet angrips. Resultatet redovisas i en rapport samt tillhörande presentation.

Exempel på forskningsområden

- Utformning av låg- eller högspänningsanläggningar
- Högspänningsteknik eller mekanik för kontaktledning, kraftledning, kabelteknik eller liknande
- Simulering av kraftsystem
- Drift och optimering av kraftsystem
- Analys av inhämtad information från kraftsystemet (Dataanalys/Big data/AI)
- Fördjupning kring en eller flera komponenter inom kraftsystemet
- Energieffektivisering och effektoptimering
- Samspelet mellan trafik, fordon och kraftsystemet
- Elkvalitet
- Jordning
- Underhållsteknik
- Livscykelanalys
- Belysning

Kvalifikationer

Du har förmåga att självständigt strukturera ditt arbete/angreppssätt i frågor och driver dessa processer vidare. Du har förmågan att göra analyser av dina resultat och kan se vilken påverkan dessa har ur ett helhetsperspektiv.

Du har lätt för att samarbeta, du är nyfiken och har viljan att driva arbetet framåt. Du har en god kommunikationsförmåga som innebär att du förmedlar budskap på ett enkelt sätt samt är lyhörd och anpassar din kommunikation till mottagaren.

Vi söker dig som:

- är driven och vill utveckla Trafikverkets kraftsystem
- håller på att avsluta en högskoleutbildning inom elkraft, maskinteknik, energiteknik, underhållsteknik eller annan för examensarbetet relevant utbildning.
- har mycket goda kunskaper i svenska i tal och skrift.

Övrig information

Koncernspråk inom Trafikverket är svenska och alla våra styrande dokument och de flesta rapporter är skrivna på svenska. Examensuppsatsen kan skrivas på engelska.

Som sökande till Trafikverket kan du eventuellt behöva gå igenom en säkerhetsprövning. Den innehåller säkerhetsprövningssamtal och registerkontroll innan anställning, om tjänsten är placerad i säkerhetsklass. I vissa fall krävs svenskt medborgarskap för säkerhetsklassade tjänster.

Ansökan

Trafikverket tar inom elkraftsområdet emot öppna ansökningar om examensarbeten där du som student har en idé till frågeställning som du vill arbeta utifrån. Vi erbjuder sedan examensarbeten utifrån att det matchar våra behov och möjligheter samt att det matchar dina behov och kunskaper.

För att hinna hantera er ansökan önskar vi att den skickas till oss senast tre månader innan önskat startdatum för examensarbetet. Antalet examensarbeten per år är begränsat inom elkraft, så ansök gärna i god tid.

Skicka in din ansökan till oss via e-post till: elkraft@trafikverket.se

Din ansökan ska innehålla:

- En kort specifikation för examensarbetet där följande framgår:
  - Bakgrund
  - Syfte
  - Frågeställning
  - Mål
- Ett personligt brev per student med:
  - En presentation av dig själv.
  - En beskrivning av din utbildning och kompetenser.

    - Ett förslag till examensarbete alternativt en beskrivning av det område inom elkraft som ni önskar att fördjupa er inom.
- CV inklusive utdrag över relevanta kurser för examensarbetet.
- Information om på vilken ort ni önskar genomföra examensarbetet, arbetets omfattning (15/30 hp), samt när i tid det ska genomföras.

Kontaktledningsfundament:
Livslängdsanalys och förslag på hållbarhetsåtgärder

Uppdragsgivare
Trafikverket ansvarar för långsiktig planering av transportsystemet för vägtrafik, järnvägstrafik, sjöfart och luftfart samt för byggande, drift och underhåll av de statliga vägarna och järnvägarna. Trafikverket prövar också frågor om statligt bidrag till svensk sjöfartsnäring och verkar för tillgänglighet i den kollektiva persontrafiken genom bland annat upphandling av avtal.

Järnvägar
Trafikverket är infrastrukturförvaltare för cirka 14 200 spårkilometer av Sveriges järnvägsnät. Den allra största delen, över 80 procent, är elektrifierad järnväg. Utöver det statliga järnvägsnätet finns industrispår till exempel hos industrier, terminaler och hamnar, spårvägar och tunnelbanor.

Syfte
Syftet med detta examensarbete är att undersöka och utveckla metoder för tillståndsbedömning av Trafikverkets befintliga kontaktledningsfundament. Arbetet ska också inkludera förslag på förbättringar av fundamentens utformning som kan bidra till en ökad livslängd och bättre möta framtida krav.

Bakgrund:
Trafikverket har under årens lopp använt flera olika typer av kontaktledningsfundament, vilket har resulterat i en stor variation av fundament i järnvägsanläggning. Fram till 1990-talet var det vanligt att kontaktledningsstolparna gjöts direkt in i fundamenten, vilket skapade en stadig men korrosionskänslig konstruktion. Under 1990-talet infördes en ny design där stolparna istället monterades med bultförband i fundamentet, vilket underlättade underhåll och kontaktledningsbyten. Ytterligare förändringar, som införandet av ihåliga fundament för att minska materialåtgången, har också implementerats.

Idag råder det osäkerhet kring om det till exempel är risk för stående vatten inuti fundamenten, och det saknas en metod för att bedöma om detta påverkar livslängden negativt. Trafikverket har heller ingen metod för att inspektera fundamenten invändigt. Denna variation i fundamenttyper och osäkerheter kring vissa utformningar har lett till att behovet av tillståndsbedömning har blivit allt viktigare, särskilt då man strävar efter att öka livslängdskraven till uppemot 100 år.

Frågeställning
- Hur kan kvarstående livslängd för befintliga kontaktledningsfundament i Trafikverkets anläggning bedömas på ett tillförlitligt sätt?
- Har de designförändringar som genomförts, t.ex. övergången till ihåliga fundament, haft en positiv eller negativ inverkan på fundamentens livslängd?
- Vilka åtgärder kan vidtas för att förlänga livslängden hos befintliga fundament så att de klarar Trafikverkets mål om en livslängd på uppemot 100 år, och kan förbättringar i utformningen minska riskerna för exempelvis korrosion och stående vatten i ihåliga fundament?

Arbetets innehåll
- Kartläggning av Trafikverkets fundament som fortfarande är i bruk i anläggningen.
- Genomföra mätningar och tester, i fält och/eller i lab, t ex med hjälp av titthålskamera eller korrosionsmätningar.
- Att utveckla en metod för att på ett tillförlitligt sätt bedöma den kvarstående livslängden för kontaktledningsfundament i Trafikverkets anläggningar, som kan användas som beslutsunderlag inom verksamhetsplaneringen.
- Föreslå ändringar i regelverk eller förbättringar i fundamentens design för att förlänga deras livslängd och säkerställa att de möter framtida krav på hållbarhet och livslängd.

Kvalifikationer
- Civilingenjörsutbildning inom Väg- och Vattenbyggnad/Samhällsteknik eller motsvarande
- Kunskaper inom hållfasthetslära, konstruktionsteknik samt betong

- Inom Trafikverket används i första hand svenska i kommunikation och i skrivna dokument. Goda kunskaper i svenska är därför meriterande men inget krav om studenten besitter goda kunskaper i engelska.
- Med fördel har sökande även kunskaper inom korrosion

Placeringsort
Arbetet bedrivs vid lärosätet alternativt vid Trafikverkets kontor i Malmö.
Handledning finns i Lund/Malmö.

Övrigt
Arbetet utförs med fördel under VT25.

Ansökan
Vi önskar att ni skickar in er ansökan till elkraft@trafikverket.se och märker mailet med ”Examensarbete kontaktledningsfundament”

Ansökan ska innehålla följande:
Personligt brev
CV inkl betygsutdrag av relevanta kurser
Önskad placeringsort
Ungefärlig tidsperiod när exjobbet kan genomföras

Urvalsprocessen sker löpande med en sista ansökningsdag 2024-11-30.

Kontakt
Hanna Närhi
E-post: hanna.a.narhi@trafikverket.se

Nyttjandegrad banarbeten

Uppdragsgivare
Trafikverket ansvarar för långsiktig planering av transportsystemet för vägtrafik, järnvägstrafik, sjöfart och luftfart samt för byggande, drift och underhåll av de statliga vägarna och järnvägarna. Trafikverket prövar också frågor om statligt bidrag till svensk sjöfartsnäring och verkar för tillgänglighet i den kollektiva persontrafiken genom bland annat upphandling av avtal.

Järnvägar
Trafikverket är infrastrukturförvaltare för cirka 14 200 spårkilometer av Sveriges järnvägsnät. Den allra största delen, över 80 procent, är elektrifierad järnväg. Utöver det statliga järnvägsnätet finns industrispår till exempel hos industrier, terminaler och hamnar, spårvägar och tunnelbanor.

Beskrivning av ämnet
Nyttjandegraden av banarbeten behöver öka och vi behöver ta fram en metod för effektiv uppföljning av utnyttjade banarbetstider i spår.

Dokumentationen av banarbeten sker genom manuella rutiner.
Trafikverket saknar möjlighet att följa upp banarbeten och utförandet av dessa för att upptäcka och eliminera slöseri samt kunna adressera problem och utmaningar dit de hör hemma (projekt/entreprenör/kontraktsskrivningar etc). En digital hantering av detta system är nyckeln för att kunna få till det.

Etablera en applikation för digital hantering av banarbeten i det operativa skedat. Utfallsdata för planerade banarbeten ska kunna exporteras för att kunna följa upp nyttjandegrad, kunna följa volymen av direktplanerade skydd osv.

Omfattning
Vi ser gärna ett arbete som görs av två personer.
I dialog med handledarna kan omfattning, upplägg och leveranser diskuteras.

Kontakt
Anders Viklund Trafikverket
E-post: anders.viklund@trafikverket.se

Arne Cronvall, Trafikverket
E-post: arne.cronvall@trafikverket.se

Simulering av transienta förlopp vid kopplingar i Trafikverkets kraftsystem för banmatning

Uppdragsgivare
Trafikverket ansvarar för långsiktig planering av transportsystemet för vägtrafik, järnvägstrafik, sjöfart och luftfart samt för byggande, drift och underhåll av de statliga vägarna och järnvägarna. Trafikverket prövar också frågor om statligt bidrag till svensk sjöfartsnäring och verkar för tillgänglighet i den kollektiva persontrafiken genom bland annat upphandling av avtal.

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Syfte
Syftet med examensarbetet är att skapa en fördjupad förståelse kring transienta fenomen som uppträder i delar av Trafikverkets kraftsystem vid t.ex. omkopplingar eller andra händelser. Främst där det finns kablar och/eller elektriska maskiner med stor kapacitans eller induktans.

Bakgrund:
Trafikverket arbetar med elkraft inom ett flertal områden. Mest känt är att vi har ett avancerat kraftsystem för att försörja elektriska tåg samt järnvägens kringutrustning. Det är ett av Sveriges största kraftnät och den sammanlagda effekten är ca 2 000 MVA.

Tågen på järnvägen matas i Sverige via ett 1-fas system med en frekvens på 16,7 Hz. Lasterna (tågen) i detta system är i ständig rörelse med varierat effektuttag. Hos Trafikverket finns omformarstationer för att omvandla elenergi med en frekvens på 50 Hz till 16,7 Hz. Detta sker både med avancerade omriktare med den senaste halvledartekniken samt med roterande omformare bestående av synkronmotorer och synkrongeneratorer. Energin förs ut till fordonen via ett nät av kontaktledningar, matarledningar, kopplingscentraler och transformatorstationer. Kontaktledningarna står i förbindelse med en strömavtagare på fordonet som via elmotorer driver tågen.

I kraftsystemet finns flera brytare och frånskiljare som används för att kunna ansluta eller koppla från olika delar av nätet. Vid omkopplingar, i förloppet mellan en driftsituation till en annan, kan transienta spänningar och strömmar uppstå. För att kunna studera sådana transienta förlopp används snabba mätsystem och simuleringsmodeller med kapacitet att hantera med korta tidssteg.

Trafikverket har med hjälp av ABB Corporate Research genomfört mätningar i delar av Trafikverkets kraftsystem för att studera transienta strömmar och spänningar vid omkopplingar i delar av 15 kV (16 Hz) systemet. Både strömmar och spänningar har registrerats och analyserats.

Nästa steg i arbetet, som detta examensarbete syftar till, är att utveckla en simuleringsmodell som representerar den del av nätet där mätningar genomförts samt genomföra analyser. Detta med syfte att fördjupa förståelsen kring de uppmätta fenomen som uppstår samt se hur förändringar i nätets uppbyggnad påverkar de transienta förloppen.

Genomförande
Examensarbetet innehåller följande arbetsmoment:

- Informationsinhämtning kring Trafikverket kraftsystem för att skapa en förståelse om dess uppbyggnad och funktion.
- Framtagning av en simuleringsmodell (i t.ex. PSCAD) som representerar den del av kraftsystemet där genomförda mätningar har genomförts.
- Analysera och förklara de fenomen som uppträder i kraftsystemet vid mätning och simulering.
- Analysera hur olika förändringar i modellen påverkar simuleringsresultaten, t.ex:

- Placering av filter samt val av filterparametrar för att minska transienter.
- Val av olika kabeltyper samt längder på kablar.
- Dokumentera och sammanställa genomföra arbete i en rapport skriven på engelska.

Krav

- Student på masternivå med kunskap inom elkraftsystem.
- Analytisk och strukturerad
- God kommunikationsförmåga på engelska, både muntlig och skriftlig.
- Utöver kraven är det meriterande om du har:

- Erfarenhet av simulering av transienta förlopp i elkraftsystem.
- Kunskap i mjukvaran PSCAD
- God kommunikationsförmåga på svenska, både muntlig och skriftlig.

Övrigt

- Examensarbetet sker i ett nära samarbete mellan Trafikverket och ABB. Handledning och simuleringar kommer att genomföras hos ABB Corporate Research i Västerås.
- Examensarbetet avser 30 hp.

Ansökan

Ansökningar för examensarbetet hanteras av ABB via den annons som du hittar här:

Master Thesis in Transient Power System Simulations representing part of the Swedish railway network in Västerås, Vaestmanland County, Sverige | Forskning & utveckling at ABB (careers.abb)

Översyn Teknisk Säkerhetsstyrning Signal (TSS)

Uppdragsgivare
Trafikverket ansvarar för långsiktig planering av transportsystemet för vägtrafik, järnvägstrafik, sjöfart och luftfart samt för byggande, drift och underhåll av de statliga vägarna och järnvägarna. Trafikverket prövar också frågor om statligt bidrag till svensk sjöfartsnäring och verkar för tillgänglighet i den kollektiva persontrafiken genom bland annat upphandling av avtal.

Järnvägar
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Syfte
Trafikverkets har en process för Teknisk Säkerhetsstyrning Signal som är Trafikverkets tolkning och anpassning av kraven enligt CENELEC 50126, 50128, 50129. Examensarbetet syftar till att utreda hur väl Trafikverkets anpassning följer kraven enligt senaste utgåvor av CENELEC.

Bakgrund
Trafikverket har under snart 22 års tid använt sig av en egen process, Teknisk Säkerhetsstyrning Signal, för att bevisa säkerheten i signalanläggningen. Anledningen till att processen är framtagen är att den ska vara en anpassning till Trafikverkets verksamhet av de CENELEC krav som finns. Trafikverket vill dock tydliggöra mappningen mellan processen och CENELEC och undersöka förbättringsmöjligheter.

Arbetets innehåll

- Utreda hur väl Trafikverkets anpassning följer kraven enligt CENELEC 50126, 50128, 50129
- Komma med förbättringsförslag, förenkling eller komplettering, på Trafikverkets process för Teknisk Säkerhetsstyrning Signal
- Dokumentera utfört arbete och resultatet i form av en slurapport.

Metod
Först och främst läsa in sig på gällande regelverk. Både Trafikverkets regelverk och CENELEC. Intervjuer med personer som är berörda eller arbetar med processen. Undersöka hur andra infrastrukturförvaltare arbetar med Teknisk Säkerhetsstyrning Signal. Både i Sverige och om möjligt andra europeiska förvaltare.

Ort
Valfri, arbete utförs i huvudsak på distans utanför Trafikverkets lokaler. Handledaren placerad i Borlänge.

Datum
Examensarbetet planeras att genomföras vårterminen 2025.

Kontakt
Mattias Karlsson, Trafikverket
E-post: mattias.a.karlsson@trafikverket.se

Modularization and sizing of HVAC components in trains

KTH Rail Vehicles, Department of Engineering Mechanics

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☒ Sustainability and Environment
☐ Other

Background

The power requirements of Heating Ventilation and Air Conditioning (HVAC) and auxiliary power in a train can be in the range of a few hundred kilowatts. Most of the trains are long term geo-fenced in their operations due to various operational constraints. Still, the HVAC systems in a particular category of train are quite standardized, even though the trains operate in very different geographies and environment. Thus, in most cases, the components can be highly oversized that can lead to the added weight on the trains as well as the lower efficiencies of the HVAC system. With the stringent targets for reducing power requirements of an operating train especially powered on batteries or fuel cell-driven, HVAC and auxiliary power sub-systems provide a great opportunity to design the next generation energy efficient HVAC systems for trains with the aim of 'Modularization and sizing of HVAC components in trains' in this project.

Problem description, tasks, and goals

Literature review on refrigeration cycles, heating, cooling, and ventilation design variables associated with components of HVAC. Sizing and design of HVAC systems in a train. Literature review on the data specification and HVAC and auxiliary power components of different generations of the trains. Suggesting design changes in the current HVAC system in the trains with an aim to adopt new technologies like thermal wheel for heat recovery, reversible heat pumps, demand-based HVAC, and operational control etc. Performing the modelling and design calculations in any convenient software(s) MATLAB/Python/IDA-ICE. Presenting case studies with different modularized designs of the systems by evaluating using various performance indicators

Type of degree project (can be both)

☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis

☐ Swedish and/or ☒ English

Is Swedish a language requirement?

☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person

Sidharth Kapoor / William Liu Research Engineer/Researcher
skapoor@kth.se/zhendong@kth.se

Crack growth rate sensitivity study for optimized rail maintenance procedures

KTH Rail Vehicles Group

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☒ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
Accurate maintenance guidelines are essential for ensuring the reliability and safety of railway systems. Rail grinding plays a crucial role in this maintenance process by addressing surface defects, such as rolling contact fatigue (RCF) cracks, and preserving optimal rail profile geometry. Traditionally, grinding has been employed as a corrective maintenance strategy to rectify identified faults. However, there is a growing emphasis on preventative maintenance, particularly scheduled grinding, to proactively eliminate potential defects before they necessitate corrective actions. A significant challenge in developing predictive maintenance strategies lies in accurately estimating RCF growth rates. Current methods rely on track inspection data or experimental observations, which are often incomplete or context-dependent across various operational scenarios and vehicle-track combinations. Furthermore, computational crack growth models frequently utilize simplified loading conditions that do not accurately reflect the complex dynamics of vehicle-track interactions.

Problem description, tasks, and goals
This project aims to enhance predictive maintenance guidelines through a sensitivity study of various crack growth rate representations across different vehicle-track configurations. By investigating the impact of vehicle-track interactions on RCF crack growth rates, this study seeks to identify suitable models for integration into existing rail grinding prediction frameworks. The master thesis work will preliminarily consist of the following tasks: 1. Conduct a literature review focused on relevant crack growth models for rails, emphasizing RCF cracking.2. Develop multi-body simulation (MBS) models for freight lines to derive dynamic loads influencing RCF cracks.3. Perform a sensitivity analysis of crack growth rates for diverse vehicle-track combinations, assessing the effect of interactions on RCF growth.4. Formulate guidelines for integrating crack growth models with existing predictive maintenance and MBS models. 5. A written report and oral presentation.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person

Jonathan Leung — Supervisor
jleung@kth.se

Carlos Casanueva — Examiner

carlosc@kth.se

Experimental and mathematical characterisation of worn-out wheel profiles

KTH Railway Group, Rail Vehicles research group

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☒ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
Rail vehicle wheels are worn out with train operation and need to be maintained after the resulting wheel profile does not meet certain requirements. The increase in digitalisation of maintenance operations has led to an increasing amount of wheel profile measurements that can be obtained, which is good for streamlining wheel maintenance processes, but making the post-processing and analysis of the profiles a challenge due to the different measurement devices and the inconsistencies inherent to the measuring process. A good understanding of the different measurement techniques, file formats, coordinate systems, etc. used is a basic condition for an automated and data-based management of wheel maintenance actions. Furthermore, a systematic characterisation enables the creation of simplified wheel profile evolution models for rail vehicle predictive maintenance and Digital Twin applications.

Problem description, tasks, and goals
The project objective is to gather digitalised wheel profile measurements from the different Swedish vehicles (X2 train profiles are already available) and systematically process them for reducing their existing limitations and use the results for mathematically approaching the worn-out shape of the profiles to analytical equations. Specifically, the project will include 1) literature review on wheel profiles and experimental measurement techniques, 2) implementation of MATLAB routines for systematic reduction of measurement errors to enable a correct comparison between profiles, 3) approximation of wheel profile wear to analytical expressions and 4) error estimation between said analytical expressions and experimental measurements. Observe that experience with MATLAB level is a prerequisite for the project.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person
Carlos Casanueva
Associate Professor at the KTH Rail Vehicles Group
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Dynamic characterisation of a railway pantograph

Dep. Of Engineering Mechanics, Rail Vehicles / SJ

Select one (or more) categories to which this degree project corresponds the best:

☒ Vehicles for Rail and Public transport

Background

The interaction between the overhead catenary lines and the vehicle's pantograph is a crucial aspect of electric railways. It provides high-efficiency power transfer at high speed but limits the possible operational speed regarding dynamic compatibility. A stable and well-adjusted contact force is required to maintain reliable power transfer and minimise maintenance efforts. Simulations have become an essential tool in research and engineering to support this adjustment and verify and improve catenary designs. Simulation models should depict the dynamic characteristics of the pantograph as accurately as possible to attain the realistic behaviour of the pantograph-catenary couple. This usually includes expensive measurements on a specialised test rig. This project aims to estimate them with a simplified approach.

Problem description, tasks, and goals

The scope of this thesis is to perform experimental structure dynamics analysis on an in-service pantograph to assess the possibility of acquiring the dynamic characteristics of a pantograph from simplified studies that do not require an entire test rig. The scope includes:

- Study existing pantograph-catenary models to understand the relevant parameters.
- Design an analysis approach to acquire these relevant parameters.
- Perform the analysis on an in-service pantograph in the maintenance workshop or KTH lab.
- Test the model's behaviour with the found parameters in a dynamic simulation.

The analysis and data processing method will be developed in discussions with the Mechanical Engineering area at the University of Malaga in Spain.

Type of degree project (can be both)

☒ Master (20 weeks)

☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis

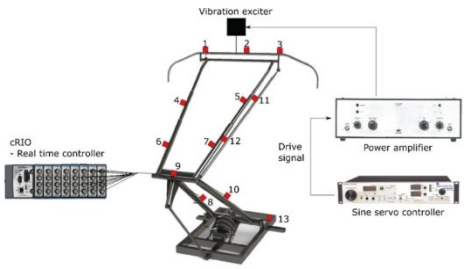
☒ Swedish and/or ☒ English

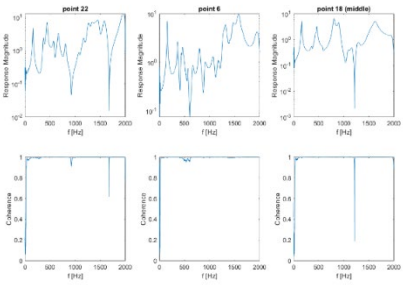
Is Swedish a language requirement?

☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person

Carlos Casanueva — Associate Professor at KTH
carlosc@kth.se





Instrumentation for wheel-rail force measurement on a scaled roller rig

KTH Royal Institute of Technology

Select one (or more) categories to which this degree project corresponds the best

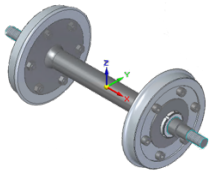
- ☐ Traffic Planning, market and Simulation
- ☐ Signalling and Traffic control systems
- ☒ Vehicles for Rail and Public transport
- ☐ Rail track, Geotechnics and Constructions
- ☐ Properties and Land use
- ☐ Electrical engineering and Power supply
- ☐ Digitalization, AI and Data Analytics
- ☐ Business Management
- ☐ Sustainability and Environment
- ☒ Wheel-rail Mechanic

Background

The division of Rail Vehicles has been developing the KTH Scaled Roller Rig, a testing facility for the experimental study of railway running gears, for both research and educational purposes. The scaled roller rig is designed with modular concepts in which both ¼ and 1/5 scaled-down running gears are possible. Moreover, some parameters can be adjusted such as wheel-rail combinations, gauges and suspension elements. The roller rig is currently in the instrumentation phase of a single wheelset where various sensors and measurements have been instrumented for verification and validation.

Problem description, tasks, and goals

The wheel-rail forces are crucial in understanding the dynamic behaviour of vehicles and running gears. In this thesis, the wheel-rail force estimation using strain gauges will be studied. The finite element analysis (FEA) and the roller rig as the test bench are needed to estimate these forces from radial strains. The finite element model will be validated using the test bench to perform calibrations. The tasks include: (1) performing FEA to determine the relation between strains and wheel-rail forces under different load cases, (2) validating FEA results using the test bench.



Type of degree project (can be both)

- ☒ Master (20 weeks)
- ☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis

☐ Swedish and/or ☒ English

Is Swedish a language requirement?

☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person

Name	Prapanpong Damsongsaeng	Role	PhD student, Supervisor
Email	pdam@kth.se		
Name	Alireza Qazizadeh	Role	Researcher, Co-supervisor
Email	alirezaq@kth.se		

Studying friction phenomena using KTH Roller Rig

Name of the company/organisation

Select one (or more) categories to which this degree project corresponds the best

☒ Vehicles for Rail and Public transport
☒ Rail track, Geotechnics and Constructions
☒ Sustainability and Environment
☒ Other (Tribology, product development)

Background
Proper wheel-rail friction management is crucial to maintaining safe and efficient train operations. High friction can limit the lifespan of the wheels and rails, while too low friction can result in an unacceptably long braking distance, risking safety. Recently, top-of-rail (TOR) products have gained growing interest due to their potential to achieve intermediate friction levels and mitigate wear. KTH has, together with industry, developed new TOR products and would like to test these in the KTH Roller Rig (see photo in lab and CAD illustration). However, there is a need to study the responses and the test parameter set-up.

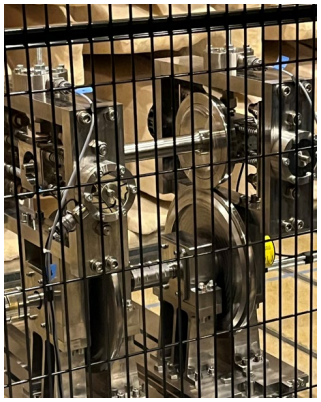
Problem description, tasks, and goals
The problem is what the KTH roller rig can actually measure in a fair way, while also minimizing the measurement uncertainties. The tasks are 1) to go through the existing documents and pedagogically describe the design and sensor techniques 2) make an uncertainty study 3) suggest ways to set-up measurements for testing TOR products and 4) if time, test one of the newly developed TOR and a reference (commercial product).

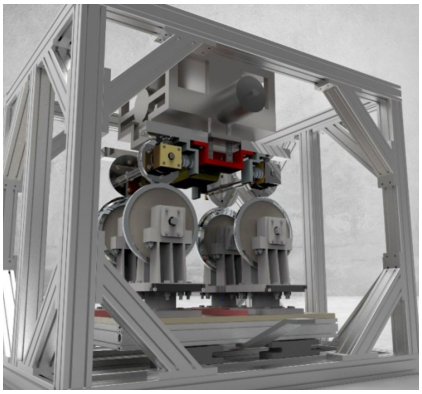
Type of degree project (can be both)
☒ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person
Name**Ellen Bergseth and Rahma Boukhris (ITM-school) and Alireza Qazizadeh (SCI-school)**
bergseth@kth.se
Supervisors: Ellen Bergseth, Rahma Boukhris, Alireza Qazizadeh





Analytical modelling of train brake systems

KTH Royal Institute of Technology

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☒ Other

Background

The centre for ECO2 vehicle design performs research in subsystem interaction modelling. Brakes are one of the most critical subsystems in rail vehicles, ensuring safety, performance, and reliability. A well-designed brake system not only ensures effective retardation, but also influences the overall energy efficiency and operational costs. Modern rail vehicles use a combination of regenerative ED braking and friction braking. Regenerative braking is desirable from an energy savings perspective, but it needs to be complemented with friction brakes, which are typically overdesigned due to safety purposes, to ensure performance and safety for emergency braking or at low speeds. Achieving the right balance in this blend of braking methods is essential to minimize brake wear and maintenance costs and improve energy efficiency. This presents design challenges such as managing brake wear, motor and brake temperatures, and overall energy consumption. Developing analytical models to understand how different blends of braking affect these factors is key to designing more efficient, sustainable rail systems and optimizing overall brake performance while maintaining a very high degree of safety.

Problem description, tasks, and goals

Brakes are complex systems that require detailed modelling to capture the interactions between them and other subsystems in the vehicle. Existing models require heavy computational resources, so there is a need for developing analytical brake models that are comparatively simple and inexpensive, while being able to capture the characteristic behaviours that define brake performance and design such as brake wear, temperature, and energy consumption. The main goal of this thesis is to develop an analytical model of the blended brake system (friction and regenerative brakes) that is capable of calculating these characteristics of brake system for different blending ratios of friction and regenerative brakes.

Tasks include: (1) Literature Review, (2) System analysis, (3) Model Development, and (4) Model validation through scenario analysis. Recommended SD2307 Rail Veh. Tech. course (P2)

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person: Carlos Casanueva, Associate Professor, email: carlosc@kth.se

Modelling of hydrogen train energy consumption

KTH Rail Vehicles Group

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☒ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☒ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☒ Sustainability and Environment
☐ Other

Background
In Sweden, about 85% of the railway network is electrified, i.e. equipped with overhead lines, which enables the operation of electric trains with high energy efficiency and environmental performance. On an EU-level, the figure is less than 60 %. Several parameters restrict the electrification of these lines, and they are instead mainly served by trains that run on diesel (including biodiesel). At EU level, research programmes, such as EU-Rail, are now underway to accelerate the development of sustainable alternatives to diesel, such as hydrogen propelled train. Hydrogen trains are a demonstrated concept with great potential for optimisation, thus requiring accurate models for the energy storage that are coupled to the operational energy consumption. One of the main challenges is that fuel cells are typically constant load machines with a long response time, while rail vehicles can require high instantaneous loads; for handling these load peaks, fuel cells must be coupled to batteries and/or capacitors increasing the complexity of the model. Accurate modelling of the electro-mechanical system is thus critical for development and optimisation studies at a railway system level, even transport system where refueling time, fueling station placement, integration with fuel stations for road vehicles could also be integrated.

Problem description, tasks, and goals
The work encompasses 1) a literature review on fuel cell vehicles, fuel cell trains, hybrid powertrain (fuel cell/battery), hydrogen on-board storage and hydrogen refuelling systems. 2) Selection and implementation of a fuel cell/battery hybrid model in MATLAB/Simulink that is designed to be integrated with the energy calculation tool developed by KTH Rail Vehicles. 3) Dimensioning of powertrain based on identified use cases (e.g. freight, light rail etc.) and 4) simulation of various vehicle/infrastructure dimensioning scenarios from an energy consumption perspective.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person
Karolina André PhD-student, Rail Vehicles group
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Analysis of the current status of rail in the transport market: barriers, enablers and priorities

KTH ABE school, Division of Transport Planning

Select one (or more) categories to which this degree project corresponds the best

☒ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☒ Digitalization, AI and Data Analytics
☒ Business Management
☒ Sustainability and Environment
☐ Other

Background
Rail is the only transport mode to have reduced GHG and CO2 emissions almost continuously since 1990, while carrying about 13% of freight and 7% of passengers on all modes. As such, rail is comparatively less polluting and more energy-efficient than other motorised means of transport. In 2018, rail accounted only for 0.4% of both transport GHG and CO2 emissions and for 2% of transport energy consumption in EU27. To meet the objectives of the European Green Deal, rail will have to take up a bigger share of passenger and freight transport.

Problem description, tasks, and goals
Greater use of rail is critical to satisfy the demand for more sustainable transport and would have substantial positive effects on pollution and energy consumption, helping to achieve the ambitious emission cuts set out in the European Green Deal. Therefore, monitoring the railway markets is necessary in order to inform policy choices, both at EU and national level. This project analyzes the infrastructural and operational barriers and challenges of rail transport at national and international level. It then analyzes the role of the rail system for society and the transport system at national and European level. Building on this, the factors that position the railways on the transport market are examined and analyzed with the help of correlation analyzes. Subsequently, potential areas of development and the best enablers are examined. Analytical methods and simulation tools are used to carry out these tasks. The Master's student should be familiar with R or another language, optimization models and statistical methods.

Type of degree project (can be both)
☒ Master (20 weeks)
☒ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person
Boban Djordjevic Researcher
boband@kth.se

Development of Digital Twin for Marshalling yard

KTH ABE school, Division of Transport Planning

Select one (or more) categories to which this degree project corresponds the best

☒ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☒ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background

European rail freight traffic has been in steady decline for around 25 years. However, political bodies such as the European Union continue to promote the further development of this mode of transport, particularly in order to improve social and environmental aspects. For example, new technologies are to be introduced in the marshaling yards where freight trains are assembled and merged. Nowadays, these marshaling yards automate some of their operations (e.g. through automatic switches and automatic brakes), but the integration of these operations with the still manual processes leads to certain problems in shunting operations. Large hubs have extensive and complex shunting operations that require advanced technology to manage hundreds of arriving/departing trains and shunting operations for more than a thousand wagons per day. With delays and limited yard resources, static, user-defined prioritization rules cannot ensure that yard operations are performed according to the priorities of individual car-based, customer-driven travel plans. Therefore, intelligent decision making on a real-time basis is required and becomes a strategic element of automation and optimization in marshaling yards.

Problem description, tasks, and goals

Freight yards are key elements of the rail system and are among the most important components of any rail infrastructure along the European corridors. Marshaling yards have a decisive influence on the accuracy, availability and cost efficiency of rail freight services. Their operation affects the overall efficiency of the door-to-door transportation chain of goods using rail transport. In order to offer customer-oriented services, improvements and optimizations in marshaling yards are essential. In this sense, efficient and effective operation of marshaling yards is at the heart of future single wagonload transportation in Europe and is closely linked to a modern real-time marshaling yard management system. It is therefore extremely important to streamline operations as much as possible, to shorten their duration where possible, but above all to improve their regularity in order to significantly improve the performance of rail as a mode of transport and to attract traffic that would otherwise be handled mainly by road. The main objective of this project should be to increase the quality of rail freight transport as well as its effectiveness and capacity by contributing to the automation of rail freight transport on European railways. This goal can be achieved by developing a digital twin for the marshaling yard. For this popular topic, a combination of optimization and simulation approaches will be performed. Therefore, the master student should be familiar with and interested in simulation tools and optimization models.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person
Boban Djordjevic Researcher
boband@kth.se

Integration of autonomous pods with railway regional lines in Sweden

Division of Transport Planning, Department of Civil and Architectural engineering, KTH

Select one (or more) categories to which this degree project corresponds the best

☒ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background

The European Pods4Rail project is developing a railway-based intermodal pod system that is autonomously operated by electrically driven vehicle with homologated transport units designed for transporting people or goods. This futuristic system will offer mobility-on-demand services integrating rail and road transport representing a completely new form of transport. The project has defined use-cases for implementation in European partner countries. More info on: https://pods4rail.eu/

Description of the proposal

In this project, you will assess the potential use-cases for integrating the futuristic autonomous pods with railway regional lines in Sweden. You will work with identified case studies in three selected regional lines by Trafikverket for which you will select potential use-cases in conjunction with use-cases defined in Pods4Rail project. You will be in contact with the relevant authorities to receive information. You will collect relevant data, conduct surveys on potential integration. There may also be possibility to model and simulate potential integration scenarios for the use-cases.

Type of degree project (can be both)

Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

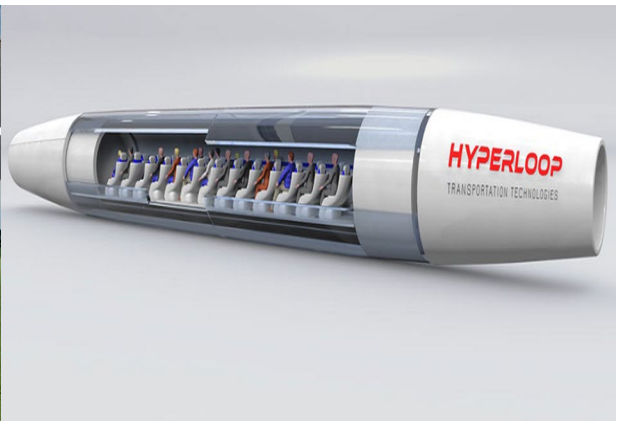
Language for the thesis

Swedish:☐ and/or English:☒

Supervisors/Contact person

Supervisors: Niloofar Minbashi, Wilco Burghout, Ivo Bruijl
If interested please send your CV to minbashi@kth.se

Potential long-distance travel demand for Hyperloop passenger transport in Sweden



Department of Civil and Architectural Engineering/Division of Transport Planning

Background

In an era characterized by dynamic urbanization and escalating travel needs, the exploration of cutting-edge transportation solutions becomes paramount. Among these innovations, the Hyperloop System (HPS) emerges as a pioneering contender, poised to reshape the landscape of long-distance commuting. The HPS, advertised by Elon Musk in his Hyperloop Alpha white paper, is a new transport mode consisting of capsules propelled by electromagnetic forces in low-pressure tubes. The system is claimed to reach maximum speeds ranging between 1000 km/h and 1200 km/h, while generating less emissions and noise compared to existing high-speed modes, namely high-speed trains and jets. However, deployment of the HPS is yet to occur, and research on factors impacting its demand and adoption is still very limited!

Description of the proposal

This master's thesis investigates the potential demand for HPS by examining passenger preferences through a stated preference choice study. The thesis is structured in three main phases. Phase 1 involves designing a survey that incorporates a stated preference choice experiment. In Phase 2, leaflets will be distributed among flight and train passengers, guiding them to the main survey to collect relevant data. Finally, Phase 3 focuses on analysing the gathered data using discrete choice modelling.

Type of degree project (can be both)
Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis
Swedish:☐ and/or English:☒

Supervisor/Contact person
Mohammad Maghrour Zefreh
momz@kth.se
Researcher

Hyperloop technology acceptance in Sweden

Department of Civil and Architectural Engineering/Division of Transport Planning

Background

Current transportation systems in metropolitan areas are increasingly reaching their limits in terms of infrastructure and ecological sustainability, particularly with congestion leading to delays, wasted resources, and high emissions. In response, new mobility solutions are being developed, including the hyperloop, a high-speed transport system using magnetic levitation in low-pressure tubes. Since Elon Musk's initial proposal, several companies have made progress, with Hardt Hyperloop and Virgin Hyperloop conducting significant tests. However, for hyperloop to become a successful mass transit solution, overcoming technical and economic challenges and ensuring public acceptance are crucial, as past experiences with high-speed rail projects have shown. This master's thesis aims to address the gap in understanding user acceptance of hyperloop technology.

Description of the proposal

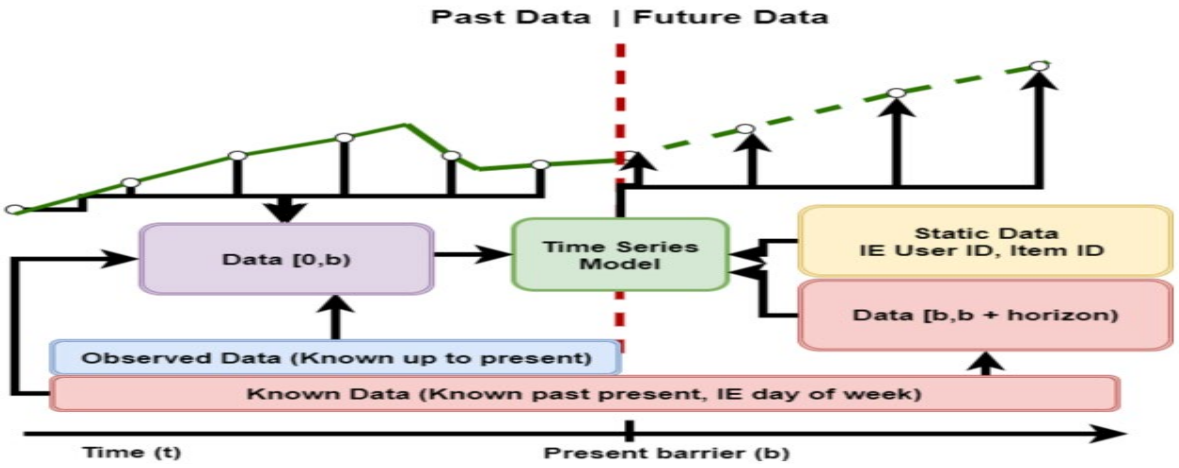
This master's thesis aims to develop a technology acceptance model to identify the factors that support user acceptance of this new technology. The thesis is structured in three main phases. Phase 1 involves designing a survey based on a state-of-the-art technology acceptance model. In Phase 2, leaflets will be distributed among flight and train passengers, guiding them to the main survey to collect relevant data. Finally, Phase 3 focuses on analysing the gathered data using a structural equation modelling framework.

Type of degree project (can be both)
Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis
Swedish:☐ and/or English:☒

Supervisor/Contact person
Mohammad Maghrour Zefreh
momz@kth.se
Researcher

Time series forecasting of future rail services



Department of Civil and Architectural Engineering/Division of Transport Planning

Background

Appraisal timetables for long-term strategic investment planning are often simplified, focusing primarily on train frequencies and travel times for different types (e.g., regional, long-distance, and freight). Ex-post studies of rail investments highlight the critical role of these timetable assumptions in demand forecasting and social benefits, as well as their contribution to forecasting errors. For instance, overly optimistic assumptions about timetables led to significant over-predictions of demand on certain Swedish railway lines. Accurate timetable assumptions are thus crucial for reliable benefit calculations of rail investments. This master's thesis aims to use historical time series of various train types to forecast future rail services, essential for constructing the timetables in the forecast year.

Description of the proposal

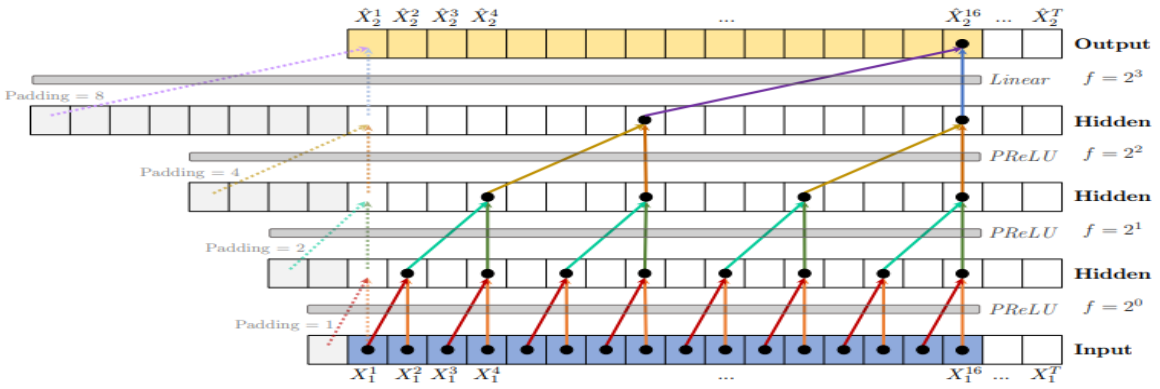
This master's thesis is structured into two main phases. Phase 1 involves time series data preparation, while Phase 2 focuses on developing a time series forecasting model to predict future rail services for the forecast year.

Type of degree project (can be both)
Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis
Swedish:☐ and/or English:☒

Supervisor/Contact person
Mohammad Maghrour Zefreh
momz@kth.se
Researcher

Applied AI for metro delay propagation prediction



Department of Civil and Architectural Engineering/Division of Transport Planning

Background

The importance of metro delay causal discovery and understanding delay propagation mechanisms cannot be overstated in the realm of urban transit management. Causal discovery unveils the intricate relationships between diverse factors contributing to metro delays, unravelling the root causes behind disruptions. Simultaneously, comprehending delay propagation sheds light on how these disruptions ripple through the entire transit network, impacting subsequent services. This dual understanding is pivotal for transit authorities to adopt proactive strategies. By addressing the root causes and foreseeing how delays propagate, authorities can implement targeted solutions to mitigate disruptions, enhance system resilience, and optimize overall service reliability.

Description of the proposal

This master's thesis aims at leveraging the applied AI (e.g., CNN and image processing) to explore metro delay propagations and discover the causation of the observed delays using large-scale vehicle location data.

Type of degree project (can be both)

Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis

Swedish:☐ and/or English:☒

Supervisor/Contact person

Mohammad Maghrour Zefreh
momz@kth.se
Researcher

Metro platform crowding: why do passengers choose a specific section of the platform to board a metro train?

Department of Civil and Architectural Engineering/Division of Transport Planning

Background

As travel demand increases in many cities around the world, overcrowding in the public transport system is recognized as a major issue, particularly during peak periods. Demand level close to capacity leads to higher congestion levels on station platforms and inside vehicles. On-platform passenger volumes influence train dwell times and passengers waiting times, as well as headway variability and service reliability. The larger the passenger load on the platform, the longer the boarding and alighting times per passenger, which results in longer train dwell times. The passenger load, however, is not uniformly distributed among different sections of the platform. Thus, there is a need to understand public transport users' motivation for choosing a specific section of the platform to board a metro train as well as their platform choice behaviour under some real-time on-board crowding information provision.

Description of the proposal

This master's thesis explores public transport users' motivations for choosing a specific section of the platform to board a metro train via a stated preference choice study. The thesis has three main phases. Phase 1: designing a survey containing a stated preference choice experiment. Phase 2: distributing leaflets (which will direct the passengers to the main survey) among the metro passengers to collect the data. Phase 3: analysing the collected data using discrete choice modelling.

Type of degree project (can be both)
Master (20 weeks):☒
Bachelor/Högskoleingenjör (10 weeks): ☐

Language for the thesis
Swedish:☐ and/or English:☒

Supervisor/Contact person
Mohammad Maghrour Zefreh
momz@kth.se
Researcher

Transit Station Crowding: Analysis & Mitigation Strategies

Division of Transport Planning

Select one (or more) categories to which this degree project corresponds the best

☒ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
Crowding mitigation at big metro stations is crucial for safety, efficiency, and the overall quality of the passenger experience. In case of emergencies, such as fires, medical incidents, or security threats, overcrowded spaces in station make evacuation and emergency responses difficult. Reducing crowding ensures safer and faster evacuation, and potentially save lives.

Problem description, tasks, and goals
T-Centralen station risks of getting overcrowded during rush hour if passenger numbers keep increasing. Your task is to develop a simulation and/or mathematical model of T-Centralen and analyse which parts of the station risk overcrowding in the future. For these locations, you should propose low-investment mitigation strategies to prevent dangerous crowd levels. These strategies could include dynamic routing of passengers, optimally configured escalator directions, platform/train crowding information for passengers, strategic and/or real-time adaptions to train timetables, among others. Your goal is to come with scientifically motivated innovative solutions to reduce crowding effects at T-Centralen, allowing passengers to more conveniently and safely navigate the station.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No ☐ No, but Swedish is a requirement for future employment

Contact person

Niloofar Minbashi Main supervisor

Joost Pieters Co- supervisor

If interested, please send your questions and CV to: minbashi@kth.se

Evaluation matrix for information relevance for personalized travel recommendations in public transport

KTH: Michelle van Ardenne

Select one (or more) categories to which this degree project corresponds the best

☐ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☒ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background

With sustainability being a main concern in the region of Stockholm, the national and local councils depend on the public transport system to be a great opportunity to reduce the environmental impact of the region (Region Stockholm, 2016). In Stockholm region, this included the Pendeltåg and metro. However, the current public transport system is facing many challenges, including disruptions and disturbances which decrease the quality of the service. Personalized passenger information can solve part of the discomfort caused by disruptions and disturbances by providing passenger information tailored to the needs and preferences of the user.

Problem description, tasks, and goals

The main objective of personalized passenger information is that only relevant information should be provided to the traveller. However, the precise meaning of the term "relevance" for passenger information is unclear, which causes for problems when providing personalized information based on the information relevance. This thesis therefore aims to create an evaluation matrix for relevance in personalized passenger information in public transport. The student will develop the information relevance evaluation matrix based on literature and expert interviews, where it will determine the indicators of the evaluation matrix. In the second step, the student will validate the evaluation matrix. There are multiple methodologies possibility for the validation, and the student will discover the best validation methodology together with the supervisors. Examples of validation methodologies are a survey study with factor analysis, sensitivity analysis, and/or predictive modelling. This project is part of a partnership between KTH and Region Stockholm, which focuses on studying the potential of personalized passenger information systems for different modes of public transport, including the Pendeltåg. The evaluation matrix is planned to be applied in simulation studies focusing on measuring the effectiveness of personalized passenger information systems and providing personalized information based on its relevance to the individual under different travel contexts.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☐ Swedish and/or ☒ English

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The effects of longer passenger trains

Transport Planning

Select one (or more) categories to which this degree project corresponds the best

☒ Traffic Planning, market and Simulation
☐ Signalling and Traffic control systems
☐ Vehicles for Rail and Public transport
☐ Rail track, Geotechnics and Constructions
☐ Properties and Land use
☐ Electrical engineering and Power supply
☐ Digitalization, AI and Data Analytics
☐ Business Management
☐ Sustainability and Environment
☐ Other

Background
In many reports and papers there seems to be a consensus that there are capacity problems in the railway system. This is often illustrated with red lines on capacity maps and gives the idea that new infrastructure is needed. However, this is based on the number of trains or train paths. For freight trains there are many projects to increase the train length up to 750 meters or even longer but there seems not to be similar discussions for passenger trains. Could longer passenger trains increase the capacity in the railway system?

Problem description, tasks, and goals
This thesis would study the capacity effects of longer passenger trains in Sweden, primarily on long-distance services. The thesis would study the infrastructure constraints, seat-capacity, passenger demands, the perspective from the operators, and calculate the capacity with different scenarios. Data for future passenger flows can be used from open data sources. The goal would be to present the effects of longer passenger trains and how they could be implemented with policy and infrastructure measures. The thesis could be done in collaboration with the industry.

Type of degree project (can be both)
☒ Master (20 weeks)
☐ Bachelor/Högskoleingenjör (10 weeks)

Language for the thesis
☒ Swedish and/or ☒ English

Is Swedish a language requirement?
☐ Yes ☒ No

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