

Student project proposal

Project title

Design and Manufacturing of a Test Platform for Linear Electric Motors

Project type ☒ MSc thesis ☐ BA semester project ☐ MSc semester project

Project responsible and e-mail

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Project description

The proposed project is part of the EPFLoop team's research into the electrification of transport, and more specifically into the propulsion of high-speed levitated vehicles. The purpose of the project is to adapt an existing test bench to study and test the performance of a new type of linear electric motor (LEM). A LEM can be considered as the “flat counterpart” of a rotary electric motor, it converts electrical energy into linear motion, and can be used for the propulsion of hyperloop vehicles.

The test platform, developed at the DESL, is equipped with a drive unit, dedicated power electronics and a three-dimensional force sensor, allowing the motor to be characterised at different set points in terms of speed and supply frequency (up to 300 km/h and 1kHz). It is used to test the performance of LEM prototypes, but also to experimentally validate analytical models developed as part of research in this field.

Tasks of the student

- Requirements definition:
 - Understand the test objectives, and constraints.
 - Translate the test specifications into clear technical requirements.
- Conceptual design:
 - Evaluate possible solutions, testing methodologies, mounting concepts, and sensors.
 - Develop initial designs for mechanical and electrical components, considering manufacturability and assembly feasibility.
- Validation:
 - Select suitable materials.
 - Verify that the solution meets the requirements through simulations.
- Manufacturing:
 - Coordinate with manufacturing, machining services or external suppliers, as required.
- Assembly:
 - Assemble the mechanical and electrical parts.
 - Install and configure control software, data acquisition systems.
- Testing:
 - Perform verification tests to ensure the platform behaves as expected.
 - Run experiments.
- Optional:
 - Electromagnetic design of the motor prototype.
 - Manufacturing of the motor (iron stacks and windings).

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Requirements

- FEMs for structural analysis.
- Fundamentals of electrical machines.
- Strong practical mindset with the ability to translate designs into effective, real-world implementations.

This project is a good opportunity to merge theoretical and practical work, resulting in an operational device.

Literature

- [1] Details about the existing test bench can be found in:
S. Rametti, L. Pierrejean, A. Hodder, and M. Paolone, “Pseudo-Three-Dimensional Analytical Model of Linear Induction Motors for High-Speed Applications,” *IEEE Trans. Transp. Electrification*, pp. 1–1, 2024, doi: [10.1109/TTE.2023.3348655](https://doi.org/10.1109/TTE.2023.3348655).
- [2] Past version of the test platform: <https://actu.epfl.ch/news/giant-wheel-used-to-test-a-linear-motor/>
- [3] General information about EPFLoop research activities can be found at <https://epfloop.ch/>



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