

Development of a Multi-body Simulation framework for Vacuum Transport Track-Pod Systems

Short Description

Global rise in mobility brings traditional modes of transport to their limits. Vacuum Transportation enables an efficient and safe way of transport. Vehicles, so-called pods, travel at high speeds on a rail through a low-pressure tube in order to minimize drag.

ETH Zurich's Hyperloop Team Swissloop participated with other University teams in Elon Musk's Hyperloop Pod Competition for three consecutive years. Due to the lack of testing infrastructure in Europe for R&D, the EuroTube Foundation aims to accelerate the breakthroughs in vacuum transportation and to push the promising concept forward by building a 3 km long test track in the canton of Valais, Switzerland.

The goal of this thesis is to develop a vehicle dynamics model, i.e. multi-body simulation framework, of the interaction between pod and track to investigate the dynamic behavior and system response at different velocities when traveling on uneven ground or small misalignments of the rail.

The result of this thesis aims to create a firm foundation for further vacuum transport vehicle dynamics investigations. This thesis is conducted at the Institute of Mechanical Systems (IMES) in collaboration with EuroTube Foundation and Swissloop.

Type	Master thesis
Partner	ETHZ, EuroTube Foundation, Swissloop
Start date	14.09.2020
End date (planned)	02.04.2021
Student(s)	tbd
Internal supervisors	Fabio Dubois, fabio.dubois@eurotube.org Nathalie Nick, nathalie.nick@swissloop.ch
External supervisors	Dr. Paolo Tiso, ptiso@ethz.ch

Work packages

- Literature review
- Study of existing models and methods (modelling, time-integration, parametrization ...) from related work
- Definition of system model and load cases from VT use cases
- Setup of a modular and parametrized model in incremental fidelity steps
- Investigation of the system performance with a parameter sensitivity analysis
- Validation of simulation framework
- Documentation and writing of report or paper
- Bonus: Implementation of an optimization layer for design optimization problems

Requirements

- High motivation and interest in the topic
- Able to work independently and be creative
- Methodological and goal-oriented working behavior
- Good theoretical understanding of multibody systems and finite element analysis
- Experience with modelling and simulation of mechanical systems
- Proficient in Python or Matlab scripting
- Knowledge about vacuum transport technologies is beneficial

Application

Please email your CV and transcript to ptiso@ethz.ch



Swissloop Pod, Competition year 2019



Planned AlphaTube Infrastructure, Collombey-Muraz, Switzerland