





# Study on Cavity-induced Turbulences by High-Speed Pod Passage for High-Speed Vacuum Transport

## **Short Description**

Global rise in mobility brings traditional modes of transport to their limits. Vacuum Transportation enables an efficient and safe way of transport. Capsules, 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 3km long test track in the canton of Valais, Switzerland.

The goal of this thesis is to develop a CFD model which investigates cavity-induced turbulences and pressure waves for near-transonic pods travelling in non-homogeneous tubes. Due to discrete/abrupt changes in the tube cross-section (cavities), asymmetric forces may arise threatening vehicle safety.

The result of this thesis provides a CFD model to test shell designs and to assess the effects of those aircavities on the safe operation of the tube.

This thesis is conducted at the Laboratory for Scientific Computing and Modelling at PSI in collaboration with EuroTube and Swissloop.

Type	Semester or Master thesis
Partner	ETHZ, EuroTube Foundation, Swissloop, PSI
Start date	tbd
End date (planned)	tbd
Student(s)	tbd
Internal supervisors	Fabio Dubois, fabio.dubois@eurotube.org Nathalie Nick, nathalie.nick@swissloop.ch
External supervisors	Dr. Bojan Niceno, Dr. Yohei Sato Prof. Konstantin Mikityuk

### Work packages

- Literature review
- Study of existing models and methods from related work
- Define cavity shapes and parameters
- Setup of CFD model in order to:
  - Investigate whether tube cavity induces turbulences: pod passing through a tube section with noncircular/homogeneous cross-section
  - Calculate resulting force profiles and impacts
- Documentation and writing of report or paper

### Requirements

- High motivation and interest in the topic
- Able to work independently and be creative
- Methodological and goal-oriented working behavior
- Prior knowledge in numerical simulations (lectures during Bachelor's or Master's
- [e.g. Berechnungsmethoden / Computational Methods for Engineering Applications / Turbulent Flows / …] or expertise acquired through own projects)
- Good theoretical understanding of fluid dynamics / computational fluid dynamics

### Application

Please fill in the application form: https://docs.google.com/forms/d/e/1FAIpQLSdy-SFLzulYiQICpFioLzTfWrsVnUZaepN4AVJ2FO3E\_11\_g/viewfor



