

CFD Simulation of Pressure Waves generated by High-Speed Body in Vacuum Tube

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 framework which investigates turbulences and pressure waves in a partial vacuum tube environment ($L \gg D$) generated by a high-speed body.

The results of this thesis provide important information for interior panelling of the AlphaTube test tube and lay a firm foundation for possible future aerodynamic studies. This thesis is conducted at the Institute of Fluid Dynamics at ETH Zürich in collaboration with EuroTube and Swissloop.

Type	Master thesis
Partner	ETHZ, EuroTube Foundation, Swissloop
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	Institute of Fluid Dynamics

Work packages

- Literature review
- Study of existing models and methods from related work
- Setup of CFD framework in order to:
 - Analyze pressure waves in vacuum tube generated by high-speed body travelling in tube
 - Investigate under what circumstances high-speed body in vacuum causes pressure wave depending on the speed profile and the blockage ratio
 - Investigate reflection of shock waves at tube ends and its impacts on travelling pods and tube
- Documentation and writing of report or paper

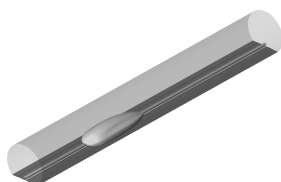
Requirements

- 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_1I_g/viewform



Swissloop Pod in Tube, Hyperloop Pod Competition 2019



Planned AlphaTube Infrastructure, Collombey-Muraz, Switzerland