TUM Hyperloop
TUM School of Engineering and Design
Technical University of Munich

Complete Design of a C-D Nozzle Cascade for Pod Convoying in Hyperloop

Type: Master Thesis
Content: theoretical / simulative
Possible start: 08.06.2026
Key words: Aerodynamics, Convoying, Drag Reduction Method, Testbench

TUM Hyperloop

Our group is researching Hyperloop technology for passenger transport. We focus on electromagnetic levitation, suspension, and propulsion, simulation of high-speed aerodynamic phenomena, cooling systems, and vehicle structure and infrastructure topics. Depending on the topic, we work on new test benches and the implementation of various experiments, computationally intensive simulations, or the design of new types of components. Our chair aims to motivate you and other students to develop modern technology for tomorrow – together as a strong team with the power of everyone.

Job Description

This thesis aims to expand the current understanding of convoying as a drag reduction strategy within the Hyperloop system. Building on a preliminary design made by the team, which consisted of the dimensional analysis and design of the testbench, the primary objective is to leverage these findings to simulate and fully design the testbench, to start construction in 2027 (not part of the thesis). This testbench will serve to experimentally evaluate the aerodynamic effects of convoying and verify its effectiveness in reducing drag under controlled conditions.

Your Tasks

- Researching and understanding Hyperloop Aerodynamics, specifically in convoying.
- Simulate the preliminary CAD geometry in Ansys Fluent (low-fidelity).
- Fully design the proposed testbench in CAD based on previous calculations.
- Preparing the testbench for implementation, including detailed drawings, component selection, and a complete bill of materials for manufacturing and procurement.
- Producing an intermediate technical documentation package summarizing the finalized design and defining the main components and specifications required for procurement.

Our Requirements

- Good knowledge of Fluid Mechanics and Aerodynamics, specifically compressible flow phenomena. Good knowledge of dimensional analysis and similarity is a must.
- Critical thinking with a precise and detail-oriented work style.
- Good knowledge of CAD theory and software, ANSYS Fluent, Python and/or MATLAB is a must.
- Good knowledge of wind tunnel technology and experimental aerodynamics is a plus.
- Strong teamwork skills and willingness to collaborate in a multidisciplinary environment. Regular on-site presence in our office, in Ottobrunn, is required.

Contact

If you are interested in working with our team, please send your **CV**, **grade report**, **motivational letter**, and supporting documentation to João Nicolau (joao.mp.nicolau@tum.de). If you have any questions, do not hesitate to contact us.