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



# Preliminary Design and CFD Analysis of a C-D Nozzle Cascade for Pod Convoying in Hyperloop Systems

Type:Master ThesisContent:theoretical / simulativePossible start:15.09.2025Key words:Aerodynamics, Convoying, Drag Reduction Method, Testbench, C-D Nozzle

## **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 existing work by the team, which has involved simulating various scenarios of pods traveling in close succession using ANSYS Fluent, the primary objective is to leverage these findings to design and simulate a preliminary—yet comprehensive—testbench. 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.
- Design a testbench to experimentally confirm the effects of convoying in Hyperloop, with special attention to dimensional analysis and the detection of compressible flow phenomena.
- Simulate the proposed test bench on ANSYS Fluent.

#### **Our Requirements**

- Good knowledge of Fluid Mechanics and Aerodynamics. Good knowledge of dimensional analysis and similarity, and compressible flow is a plus.
- Critical thinking with a precise and detail-oriented work style.
- Reliable and consistent in delivering on agreed tasks and responsibilities.
- Good knowledge of CAD, ANSYS Fluent, Python and/or MATLAB is a plus.

#### **Our Offer**

- Working with students and researchers in a highly motivated young research team.
- Experience in a new field of research which is gaining in importance.

## Contact

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