



CASE STUDY /

Ansys + Avishkar Hyperloop

“Ansys simulation and the learning resources provided by Ansys helped our team with multi-disciplinary optimization and system integration across subsystems in a streamlined and efficient way.”

Shrid Suresh

Team Lead / Avishkar Hyperloop

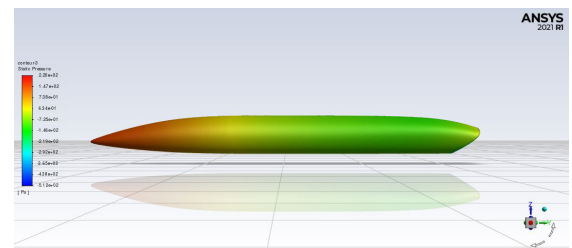
Avishkar Hyperloop Uses Ansys to Design a Hyperloop Tube, Chassis, and Aerodynamic Shell

Avishkar Hyperloop participates in the annual European Hyperloop Week (EHW). The categories change every year and are judged by the design, simulations, manufacturing, and the overall engineering of the product. It is nearly impossible to accurately calculate things such as stress, deformation, and pressure contours with hand calculations. Ansys is a necessary tool for the Avishkar Hyperloop team to simulate loading conditions and develop a lightweight chassis and extremely thin aerodynamic shell. Saving weight enables usage of less propulsive and levitating power and, hence, a lightweight pod and thin shell.

/ Challenges

The propulsion, braking, and levitation systems are mounted on the chassis and each of these systems exert forces that can deform it. It is very important for the team to create a chassis design that will not deform while being as lightweight as possible.

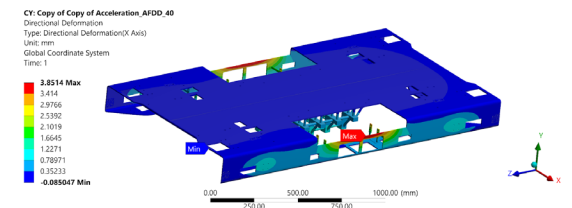
The aerodynamic shell design need to be extremely lightweight. The lighter weighted the shell is the lesser power is required from the batteries for levitation and propulsion. This required the team to optimize the shape and thickness of the shell.



Full Scale Pod Shell Design simulated and validated with Ansys

/ Engineering Solution

Our team created a preliminary shape of the chassis and applied the forces, displacement constraints and boundary conditions so deformation and stresses could be simulated. Once a basic structure for the chassis was finalized, topology optimization helped us remove any unwanted material and ensure adequate stiffness of the structure. Overall, the mass of the chassis was optimized by more than 60%.

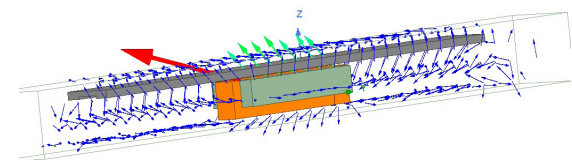


Ansys simulated Deformations of Chassis of Pod

A similar methodology was followed for our Aerodynamic shell.

/ Benefits

Ansys was a crucial tool for designing and optimizing the chassis and aerodynamic shell of the hyperloop pod. Specifically, they reduced the mass of the chassis by more than 60%. Similarly, the drag for the shell after simulation came out to be less than 0.2, thereby reducing the drag force by a great degree. Tests done with Ansys were also validated with a scaled down version of the shell in a wind tunnel, adding to the engineering feel for team members.



Simulations of Magnetic Field Strength and Lift Force of Electromagnetic Suspension

/ Ansys Products Used

- Ansys Workbench

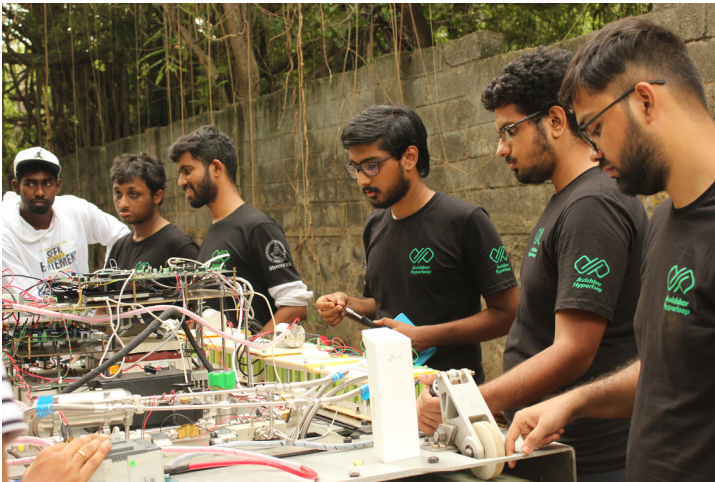
/ Company Description

Avishkar Hyperloop is a student team from IIT Madras focused on revolutionizing transportation with sustainable hyperloop technologies. They are a 72-member team backed by the Indian Railways, drawing members from 11 academic disciplines and a variety of UG and PG programmes at IIT Madras, bound by a shared passion for this futuristic mode of transportation.

Avishkar participated in the 2022 European Hyperloop Week held in Delft, the Netherlands. The team finished the competition in the global top-5 and was the only Asian team to do so, with recognition in key categories like Electrical Systems, Traction Systems, and the Complete Pod category.



Pod made by Avishkar Hyperloop



Team members working on Pod



Full Team Photo