

# Lab # 01: Flow Visualization with Smoke Wind Tunnel

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- You should review and understand the concepts of Euler Approach and Lagrangian Approach to describe the motion of the fluid flow.

The Eulerian Approach and the Lagrangian Approach are two fundamental methods used to describe fluid flow motion. In the Eulerian approach, the focus is on fixed points in space, and the properties of the fluid, such as velocity and pressure, are observed at these stationary points over time. This approach provides a way to analyze the behavior of the fluid at specific locations without following individual fluid particles. On the other hand, the Lagrangian approach tracks the movement of individual fluid particles, considering their trajectories and changes in properties as they move through space. It offers a particle-centered perspective, emphasizing the continuous tracking of fluid elements over time.

- You should review and understand the concepts of path lines, streak lines, and streamlines.

Path lines, streak lines, and streamlines are three distinct concepts that describe the motion of fluid particles. Path lines represent the actual paths traced by individual fluid particles over time, providing a comprehensive view of their trajectories. Streak lines are instantaneous snapshots of the paths of particles released from a fixed point in the flow at a specific moment, forming visible curves that capture the flow's history. Streamlines, meanwhile, are imaginary lines that are tangent to the velocity vectors of the fluid at any given instant, offering a snapshot of the flow's instantaneous direction.

- You should understand the differences and connections between the concepts of path lines, streak lines, and streamlines.

Path lines, streak lines, and streamlines are interconnected concepts that describe the motion of fluid particles but emphasize different aspects. While path lines detail the entire history of a particle's movement, streak lines offer a snapshot of fluid motion at a given moment, and streamlines represent the instantaneous direction of the flow. In a steady state flow, they all coincide.

- You should understand the concepts of blunt body, streamlined objects, angle of attack, attached flow, flow separation, airfoil stall, and wingtip vortex.

A blunt body is an object with a rounded or blunt front end, causing high drag and turbulence. Streamlined objects, in contrast, have smooth, aerodynamic shapes that minimize drag. The angle of attack is the angle between an airfoil or wing and the oncoming air. Attached flow occurs when the air smoothly follows the object's contour, while flow separation happens when the air detaches, leading to increased drag. Airfoil stall refers to a sudden loss of lift on an airfoil due to high angles of attack. Lastly, wingtip vortex is the rotating flow around the tips of aircraft wings, creating induced drag and turbulence.