# TEACHING SEMINAR

## Lift and Drag in Subsonic Flow

**THURSDAY, MAY 9TH, 2:00 PM – 2:50 PM**

**ARMS B071**

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ABSTRACT

Lift and drag are fundamental forces that play a crucial role in airplane performance, efficiency, and safety, especially in subsonic flow where the air is slower than the speed of sound. These forces have a broad spectrum of applications from conventional airplanes to sports engineering. This presentation aims to discuss the generation of aerodynamic forces acting on the airplane during flight under subsonic flow conditions. Regardless of the body shape, the basic recourses of aerodynamic forces are pressure and shear stress distribution over the body. One of the primary aerodynamic forces is the lift force perpendicular to the flow velocity that is generated by the net pressure difference between the upper and lower surfaces of the wing. Conversely, drag force is an air-resistive force in the opposite direction to the airplane motion that is composed of pressure and skin friction drag. The pressure drag arises from the pressure difference between the front and back of the airplane and skin friction drag results from the shear stress acting parallel to the body surface due to the viscous effects. The presentation will discuss the dimensionless lift and drag coefficients and the factors (e.g. angle of attack) impacting these quantities. Additionally, it will highlight engineering tools and methodologies commonly used in calculating the aerodynamic coefficients such as wind tunnel testing and computational fluid dynamics (CFD). We will also review the recent technological advancements aiming to improve the efficiency and overall performance of the airplane.


BIOGRAPHY

Dr. Aslihan Vuruskan served as a Senior Aerospace Engineer at WingXpand, where her focus was on the aerodynamic design, modeling, and analysis of Unmanned Aerial Vehicle (UAV), computational fluid dynamics (CFD), and UAV design. Between 2020 and 2023, she held the position of Assistant Professor in the Department of Mechanical Engineering at Florida Polytechnic University. Her research interests are aerodynamics, robust design, CFD, computational methods, eVTOL UAVs, and hypersonic flow. Her recent research project funded by NASA FSGC focused on the deterministic and robust aerothermal shape optimization of hypersonic vehicles. During her appointment, she taught a variety of undergraduate and graduate courses in mechanical and aerospace engineering. She received her PhD in Aerospace Engineering from the Missouri University of Science and Technology in 2019. Her PhD study focuses on robust aerodynamic shape optimization of aircraft systems in a transonic, viscous, turbulent flow. Her research work was recognized with the prestigious Amelia Earhart Fellowship in 2017, which is awarded annually to 35 women from all over the world who demonstrate superior academic records in the field of aerospace-related engineering and sciences during their PhD education. She also received the AIAA Young Professional Award in 2019 for her contribution to the field of robust aerodynamic shape optimization. She holds an M.Sc degree in Aeronautical and Astronautical Engineering from Istanbul Technical University. She also received a B.Sc degree in Aeronautical Engineering in 2012 and Mechanical Engineering in 2013 from Istanbul Technical University.

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