McGill University

Mechanical Lab

MECH 362

Study of Drag and Lift Coefficients in Subsonic Wind Tunnel

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Contents

List of Symbols

α	Angle of attack
μ	Fluid viscosity
ρ	Fluid density
A	Projected area of the body facing the flow
C_D	Drag coefficient
C_L	Lift coefficient
d	Projected Diameter
l	Projected Cross-Sectional Length
R_A	Air Gas Constant
R_W	Water Vapor Gas Constant
w	Projected Cross-Sectional Width
x	Specific Humidity
C	Constant parameter
D	Drag Force
L	Lift Force
v	Fluid (or body) speed

1 Experiment Objectives

This experiment will investigate:

1. The relationship between Reynolds number and drag coefficients for different shapes.
2. The relationship between angle of attack and lift/drag coefficients for an airfoil with closed and open flap configurations.

Moreover, the experimentally obtained drag and lift coefficients of different shapes will be compared to those published in the literature.

2 Apparatus Description

The wind tunnel used in this experiment is an open wind tunnel type. The fan controlling the flow is driven by an AC motor and an inverter speed control unit, allowing smooth control of air speed.

The air speed is indicated on an inclined manometer.

The wind tunnel is equipped with a two-component aerodynamic balance which measures both the lift and drag components exerted on the model.

During all tests, it is important to make sure the tunnel is closed and the cover plate is properly placed to minimize external air entry.

Five drag models are included, which all have the same equatorial diameter. These models consist of:

- Sphere
- Hemisphere, concave to air flow
- Hemisphere, convex to air flow
- Circular disc
- Streamlined shape
- Support rod (for calibration purposes)

Moreover, the airfoil is equipped with an adjustable slot and flap. The angle of attack is also adjustable.

References

[1] Engineering Toolbox. Density of Dry Air, Water Vapor and Moist Humid Air. [Online]. Available: http://www.engineeringtoolbox.com/density-air-d_680.html

[2] Engineering Toolbox. Dry air properties. [Online]. Available: http://www.engineeringtoolbox.com/dry-air-properties-d_973.html

[3] Engineering Toolbox. Laminar, transitional or turbulent flow. [Online]. Available: http://www.engineeringtoolbox.com/laminar-transitional-turbulent-flow-d_577.html