Lab 1a Wind Tunnel Testing Principles & Lift and Drag Coefficients on an Airfoil

OBJECTIVES

- Calibrate the RPM/wind speed relation of the wind tunnel.
- Measure the drag and lift coefficients of an airfoil as a function of the angle of attack and Reynolds number.
- Measure the RMS fluctuations of pressure
- Perform a complete uncertainty analysis on the measured drag and lift coefficients.

EQUIPMENT

| Name | Model | S/N |
|----------------------|-----------|-----|
| Flowtek Wind Tunnel | | |
| Pressure Transducers | | |
| Airfoil NACA 2415 | | |
| NI DAQ Card | PCI-6024E | |
| Computer | | |

The wind tunnel flow measurement workstation consists of 8 pressure tubes connected to pressure transducers to measure pressure relative to atmospheric pressure, Flowtek wind tunnel with control panel to control air flow, and data acquisition system (DAQ NI PCI-6024E and LabView 2010 software). In this experiment, you will perform air pressure on the surface of an airfoil.

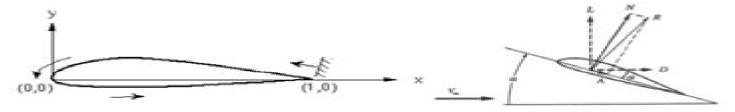
This lab was designed to be completed in 2 lab sessions. Data processing may take 1 or 2 more sessions. Data processing should be performed as data is taken, to guarantee good results.

REQUIRED READING

Read reference [1] for introduction and operation of the wind tunnel. For review in fluid mechanics see [2]. Experimental data is available for Re = 200,000 in [3] and for other Re in [4].

THEORY

Airfoil theory is well described in [2], chapter 8.7. The standard coordinate definitions are shown in Fig. 1.



Lab Report For Drag And Lift Force

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TRRL Laboratory Report Transport and Road Research Laboratory,1983 Report United States. National Bureau of Standards,1968 Scientific and Technical Aerospace Reports ,1992 Laboratory Report LR National Aeronautical Establishment (Canada),1958 U.S. Government Research Reports ,1962 NBS Special Publication ,1964

Thermo-Fluid Dynamics of Two-Phase Flow Mamoru Ishii, Takashi Hydraulic Research in the United States ,1964 Hibiki, 2010-11-10 Thermo fluid Dynamics of Two Phase Flow Second Edition is focused on the fundamental physics of two phase flow The authors present the detailed theoretical foundation of multi phase flow thermo fluid dynamics as they apply to Nuclear reactor transient and accident analysis Energy systems Power generation systems Chemical reactors and process systems Space propulsion Transport processes This edition features updates on two phase flow formulation and constitutive equations and CFD simulation codes such as FLUENT and CFX new coverage of the lift force model which is of particular significance for those working in the field of computational fluid dynamics new equations and coverage of 1 dimensional drift flux models and a new chapter on porous media formulation **Miscellaneous Publication - National Bureau of Standards** United States. National Bureau of Standards.1934 Progress in Aeronautical Sciences D. Küchemann, P. Carrière, B. Etkin, 2016-07-02 Progress in Aeronautical Sciences Volume 8 is a collection of papers that covers the widening field of aeronautical sciences The first article deals with problems in fluid mechanics and practical aerodynamics This paper includes reducing problems to integral equations the comparison of calculated results with exact analytic solutions and with experimental pressure distributions using various configurations. The book follows this discussion with a review of the methods for designing swept winged aircraft including the design of a symmetrical fuselage combination at zero incidence The text also reviews the propulsion characteristics of a hypothetical aircraft flying at hypersonic speeds and then focuses on air breathing engines to power hypersonic aircrafts of which the scramjet is the most promising The publication renders a comprehensive report on the viscous flow in boundary layers in ducts under rarefied conditions The book then reviews investigations made on the viscous flow through tubes both in continuum flow and in free molecule flow Another paper develops the fundamental mathematical and physical bases of magnetohydrodynamic flow through ducts in the presence of an applied electromagnetic field Such review is useful when applied to electromagnetic flowmeters pumps or generators. The volume can be helpful for aerodynamic researchers aviation technologists and designers and aeronautical engineers

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