Chapter 4 Laminar Boundary Layers

1. Historical Background and Boundary Layer Concepts

2. Boundary Layer Theory

   Part 1

   a. Integral Methods: Flat Plate

   b. Boundary Layer Equations

   Part 2

   c. Similarity Solutions

      i. Flat Plate: Blasius Solution

      ii. Falkner-Skan Wedge Flows

      iii. Flat with Wall Suction or Blowing

   Part 3

   d. Momentum Integral Methods

   Part 4

   e. Boundary Layer Separation

      i. Transition, Pressure Gradient, and Boundary-Layer Separation

      ii. 3D Separation

         1. Definitions and Examples Steady and Unsteady Separation.

         2. 3D Separation Patterns

      iii. Flow Past Cylinders and Spheres

      iv. Sports Ball Dynamics

      v. Unsteady Separation

3. Free Shear Flows
    a. Mixing Layers
    b. Jets
        i. 2D
            1. Derivation 1
            2. Derivation 2
            3. Derivation 3
        ii. 2D Wall Jet
        iii. Axisymmetric (Round) Jet
        iv. Axisymmetric (Round) Jet with Swirl
    c. Wakes
        i. 2D
            1. Far Wake Flat Plate
            2. Non-Lifting Body
                a. Panton
                b. White
        ii. Axisymmetric (Round) Wake
        iii. Simplified Betz Method
            1. Clark Y Reference Data

4. Additional Topics
    a. Inlet Duct Flow
    b. Rotationally Symmetrical Boundary Layers
    c. Axisymmetric Boundary Layers
    d. 3D Boundary Layers
    e. Asymptotic Expansions
    f. Unsteady Boundary Layers

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