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 Plate 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. Axisymmetric Boundary Layers
    b. 3D Boundary Layers
    c. Boundary layer with constant transverse pressure gradient