

Boundary and Interior Layers: Computational and Asymptotic Methods

Boundary and interior layers are ubiquitous in various scientific and engineering applications, such as fluid mechanics, heat transfer, and applied mathematics. These layers arise when the governing equations exhibit rapid changes in a localized region, leading to complex and challenging problems to solve.

This book provides a comprehensive to computational and asymptotic methods for analyzing boundary and interior layers. It covers a wide range of topics, including:



Boundary and Interior Layers, Computational and Asymptotic Methods BAIL 2024 (Lecture Notes in Computational Science and Engineering Book 120)

by Lee DeForest

★★★★☆ 4.4 out of 5

Language : English

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Print length : 219 pages

Screen Reader : Supported



- Mathematical foundations of boundary and interior layers
- Asymptotic expansions and matched asymptotic expansions
- Numerical methods for solving boundary and interior layer problems

- Applications to fluid mechanics, heat transfer, and other fields

Chapter 1: Mathematical Foundations of Boundary and Interior Layers

This chapter provides the mathematical background necessary for understanding boundary and interior layers. It covers topics such as:

- The Navier-Stokes equations
- The boundary layer equations
- The interior layer equations
- Similarity solutions

Chapter 2: Asymptotic Expansions and Matched Asymptotic Expansions

This chapter introduces asymptotic expansions and matched asymptotic expansions, which are powerful tools for analyzing boundary and interior layers. It covers topics such as:

- The method of matched asymptotic expansions
- The principle of outer and inner expansions
- Matching conditions
- Applications to boundary and interior layer problems

Chapter 3: Numerical Methods for Solving Boundary and Interior Layer Problems

This chapter describes numerical methods for solving boundary and interior layer problems. It covers topics such as:

- Finite difference methods
- Finite element methods
- Spectral methods
- Boundary element methods
- Applications to boundary and interior layer problems

Chapter 4: Applications to Fluid Mechanics

This chapter applies the methods developed in the previous chapters to fluid mechanics problems. It covers topics such as:

- Boundary layers in laminar flows
- Boundary layers in turbulent flows
- Interior layers in jets and wakes
- Applications to aerodynamics and turbomachinery

Chapter 5: Applications to Heat Transfer

This chapter applies the methods developed in the previous chapters to heat transfer problems. It covers topics such as:

- Boundary layers in heat transfer
- Interior layers in combustion
- Applications to thermal engineering and materials science

Chapter 6: Applications to Other Fields

This chapter applies the methods developed in the previous chapters to other fields, such as:

- Chemical engineering
- Geophysics
- Bioengineering
- Applied mathematics

This book provides a comprehensive to boundary and interior layers, with a focus on computational and asymptotic methods. It is suitable for graduate students and researchers in applied mathematics, fluid mechanics, heat transfer, and other related fields.



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