

Contents

Preface ix

EXTERNAL BOUNDARY LAYER FLOWS

Similarity Solutions for Laminar External Boundary Region Flows
B. Gebhart 3

An Investigation of Laminar Natural Convection Heat Transfer around an Isothermal U-Shaped Body
E. Paykoç and Y. Gögüş 36

Thermal Plumes
Y. Jaluria 51

The Method of Scale Analysis: Natural Convection in Fluids
A. Bejan 75

PLANE LAYERS

Natural Convection in Horizontally Unbounded Plane Layers
I. Catton 97

Stability of Natural Convection in a Vertical Fluid Layer
Y. Yener, S. Kakaç, and F. F. Maia 135

Thermal Stability of a Vertical Fluid Layer with Volumetric Energy Sources
M. N. Özisik 156

Natural Convection in Plane Layers and Cavities with Volumetric Energy Sources
F. A. Kulacki and D. E. Richards 179

TURBULENCE MODELING

Equations and Coefficients for Turbulence Modeling
R. J. Yang and W. Aung 259

ENCLOSURE FLOWS

Turbulent Buoyant Flow in Vented Simple and Complex Enclosures
K. T. Yang and J. R. Lloyd 303

Natural Convection in Enclosures Containing Tube Bundles
M. Keyhani and F. A. Kulacki 330

Natural Convection-Radiation Interaction in Enclosures
K. T. Yang and J. R. Lloyd 381

v

STRATIFIED FLUIDS

Convective Flow in a Stably Stratified Environment

Y. Jaluria 413

The Flow of Stratified Air Layers in Horizontal Channels

C. J. Hoogendoorn 443

Buoyancy Induced Flows Caused by Inert Solids Immersed in Stratified Fluids

G. L. Quarini 461

NATURAL CONVECTION IN POROUS MEDIA

Natural Convection in a Porous Medium: External Flows

P. Cheng 475

Natural Convection Heat Transfer in Porous Media

I. Catton 514

The Method of Scale Analysis: Natural Convection in Porous Media

A. Bejan 548

Natural Convection in Porous Media under Non-Darcian and Non-Uniform Permeability Conditions

C. L. Tien and J. T. Hong 573

Natural Convection in Shallow Open Cavities with Clear and Porous Media

C. L. Tien and J. T. Hong 588

Limiting Behaviors in Porous Media Cavity Flows

P. A. Blythe, P. G. Daniels, and P. G. Simpkins 600

NUMERICAL AND EXPERIMENTAL METHODS

Numerical Solutions in Laminar and Turbulent Natural Convection

S. Güçeri and B. Farouk 615

Numerical Simulation of Natural Convection in Porous Media

D. B. Spalding 655

Experimental Methods in Natural Convection

C. J. Hoogendoorn 674

MIXED CONVECTION

Mixed Convection in Laminar Boundary-Layer Flow

T. S. Chen, B. F. Armaly, and W. Aung 699

INFLUENCES OF THE TEMPERATURE-DEPENDENT PROPERTIES

The Effects of the Temperature-Dependent Fluid Properties on Natural Convection—
Summary and Review

S. Kakaç, Y. Yener, and E. Ateşoğlu 729

Natural Convection in the Near Critical Region and Its Application in Heat Pipes

E. W. P. Hahne 774

Heat Transfer in the Critical Region of Binary Mixtures

M. Durst and K. Stephan 827

MELTING AND SOLIDIFICATION

Natural Convection in Melting and Solidification

R. Viskanta 845

APPLICATIONS

Natural Convection in Solar Systems

F. Kreith and R. Anderson 881

Natural Convection Suppression in Solar Collectors

C. J. Hoogendoorn 940

Natural Convective Cooling of Electronic Equipment

Y. Jaluria 961

Boundary Region Transport in Cold Pure and Saline Water

B. Gebhart 987

Natural Convection in Horizontal Containers with Applications to Crystal Growth

P. G. Simpkins and K. S. Chen 1010

A Review of Natural Circulation Loops

A. Mertol and R. Greif 1033

MISCELLANEOUS

Double-Diffusive Natural Convection

R. Viskanta, T. L. Bergman, and F. P. Incropera 1075

Natural Convection of Electrically Conducting Fluids in the Presence of Magnetic Fields

P. S. Lykoudis 1100

Laser Induced Buoyancy and Forced Convection in Vertical Tubes

D. DiGiovanni, C. Y. Wang, T. F. Morse, and J. W. Cipolla 1118

Natural Convection Cooling of a Cold Neutron Source with Vaporizing Deuterium at Temperatures of 25K

H. Hoffmann 1140

UNRESOLVED PROBLEMS OF NATURAL CONVECTION

Research Directions in Natural Convection

W. Aung and Y. Yener 1155

Index 1173