

CONTENTS

Preface

page ix

Part I Bénard Convection and Rayleigh–Bénard Convection	1
1 Bénard's Experiments	4
2 Linear Theory of Rayleigh–Bénard Convection	11
2.1 Rayleigh's Work	11
2.2 The Onset of Convection	13
2.3 The Cellular Patterns	25
2.4 Subcritical Convection	32
3 Theory of Surface-Tension-Driven Bénard Convection	36
3.1 Linear Theory of Bénard Convection	36
3.2 Nonlinear Theory of Bénard Convection	47
4 Surface-Tension-Driven Bénard Convection Experiments	54
5 Linear Rayleigh–Bénard Convection Experiments	63
5.1 Early Experiments	63
5.2 The Planform of Convection	65
5.3 The Critical Wavelength	83
5.4 The Critical Rayleigh Number	84
6 Supercritical Rayleigh–Bénard Convection Experiments	87
6.1 Steady, Moderately Supercritical Convection	87
6.2 Oscillatory Rayleigh–Bénard Convection	99
6.3 Supercritical Heat Transfer	106
6.4 Turbulent Convection	116
7 Nonlinear Theory of Rayleigh–Bénard Convection	119
7.1 Weakly Nonlinear Theory	119
7.2 Moderately Nonlinear Convection	131
7.3 The Landau Equation	136
7.4 Models of Supercritical Convection	139

8	Miscellaneous Topics	153
8.1	Non-Boussinesq Convection	153
8.2	Convection with Nonuniform Heating	162
8.3	Convection with Rotation	173
8.4	Convection in and on Spheres	187
	Review	194
Part II	Taylor Vortex Flow	197
9	Circular Couette Flow	203
10	Rayleigh's Stability Criterion	207
11	Taylor's Work	210
11.1	Linear Theory of the Instability	210
11.2	Taylor's Experiments	219
12	Torque Measurements	226
13	Supercritical Taylor Vortex Experiments	231
13.1	Wavy Taylor Vortices	231
13.2	Axisymmetric Supercritical Vortices	242
13.3	End Effects	248
13.4	Turbulent Taylor Vortices	256
13.5	Experiments with Two Rotating Cylinders	263
14	Nonlinear Theory of Taylor Vortices	268
14.1	Weakly Nonlinear Axisymmetric Taylor Vortices	268
14.2	Theory of Wavy Taylor Vortices	274
14.3	Moderately Supercritical Axisymmetric Taylor Vortices	281
15	Miscellaneous Topics	291
15.1	Taylor Vortices between Eccentric Cylinders	291
15.2	Taylor Vortices between Conical Cylinders	299
15.3	Taylor Vortices between Rotating Spheres	301
	Review	307
	<i>References</i>	309
	<i>Index</i>	333