

# CONTENTS

*Acknowledgments* *page* ix

*Preface* xi

## I. INTRODUCTION

### PART A

<b>1.1</b>	A few simple experiments	<b>I</b>
<b>1.2</b>	Equations of motion	<b>5</b>
<b>1.3</b>	Theoretical survey	<b>8</b>

### PART B

<b>1.4</b>	A formulation for stratified fluids	<b>11</b>
<b>1.5</b>	Rudiments of vorticity theory	<b>18</b>
<b>1.6</b>	Rudiments of viscous boundary layer theory	<b>23</b>

## 2. CONTAINED ROTATING FLUID MOTION: LINEAR THEORIES

<b>2.1</b>	Classification	<b>28</b>
<b>2.2</b>	Almost rigid rotation	<b>28</b>
<b>2.3</b>	The Ekman layer	<b>30</b>
<b>2.4</b>	Spin-up	<b>34</b>
<b>2.5</b>	The initial value problem: formulation	<b>38</b>
<b>2.6</b>	The geostrophic mode	<b>43</b>
<b>2.7</b>	Inertial waves	<b>51</b>
<b>2.8</b>	Mean circulation theorem	<b>54</b>
<b>2.9</b>	Viscous dissipation	<b>56</b>
<b>2.10</b>	The initial value problem: solution and critique	<b>58</b>
<b>2.11</b>	Special cases	<b>60</b>
<b>2.12</b>	Motion in a sphere	<b>63</b>
<b>2.13</b>	Precession and the problem of forced motions	<b>68</b>

<b>2.14</b>	Resonance in a sphere	<i>page</i> 78
<b>2.15</b>	Motion in a cylinder	81
<b>2.16</b>	Rossby waves: part one	85
<b>2.17</b>	Steady motions and Ekman layers	91
<b>2.18</b>	Vertical boundary layers	97
<b>2.19</b>	Steady motions and vertical shear layers	106
<b>2.20</b>	A 'wind-driven' circulation	118
<b>2.21</b>	Some effects of stratification	124

### 3. CONTAINED ROTATING FLUID MOTION: NON-LINEAR THEORIES

<b>3.1</b>	Introduction	133
<b>3.2</b>	Boundary layer on an infinite plate	133
<b>3.3</b>	Boundary layer on a finite plate	139
<b>3.4</b>	Motion between concentric plates	145
<b>3.5</b>	Spherical boundaries	150
<b>3.6</b>	Momentum-integral methods	153
<b>3.7</b>	Spin-up	160
<b>3.8</b>	Some experiments with non-linear phenomena	173
<b>3.9</b>	Large angle precession	176
<b>3.10</b>	Vortex flows and similarity solutions	181

### 4. MOTION IN AN UNBOUNDED ROTATING FLUID

<b>4.1</b>	Classification	185
<b>4.2</b>	Plane inertial waves	185
<b>4.3</b>	Slow motion along the axis of rotation	192
<b>4.4</b>	Oscillatory motion	200
<b>4.5</b>	Wave propagation in a uniform current	204
<b>4.6</b>	Motion along the rotation axis at moderate speeds	213
<b>4.7</b>	Time-dependent considerations	222

## 5. DEPTH-AVERAGED EQUATIONS: MODELS FOR OCEANIC CIRCULATION

<b>5.1</b>	Introduction	<i>page</i> 225
<b>5.2</b>	Depth-averaged equations	225
<b>5.3</b>	Oceanic models	234
<b>5.4</b>	Steady circulations and inertial boundary layers	238
<b>5.5</b>	Rossby waves: part two	246
<b>5.6</b>	Numerical studies	254
<b>5.7</b>	Flow between concentric spheres	262

## 6. STABILITY

<b>6.1</b>	Introduction	271
<b>6.2</b>	Rayleigh's criterion	271
<b>6.3</b>	Stability of the Ekman layer: experiments	275
<b>6.4</b>	Stability of the Ekman layer: theory	281
<b>6.5</b>	Vertical shear layers	288
<b>6.6</b>	Stratified fluids	292
<b>6.7</b>	Thermal convection in a rotating annulus	293

	<i>Notation Guide</i>	300
--	-----------------------	-----

	<i>Bibliography and Author Index</i>	305
--	--------------------------------------	-----

	<i>Subject Index</i>	321
--	----------------------	-----

	<i>Supplementary References</i>	
--	---------------------------------	--