

Preface	p. xi
Acknowledgements	p. xiii
List of Symbols	p. xv
Introduction	p. 1
Application of Centrifugal Compressors	p. 2
Achievable Efficiency	p. 5
Diabatic Flows	p. 14
Transformation of Energy in Radial Compressors	p. 19
Performance Map	p. 25
Theoretical Performance Curve	p. 25
Finite Number of Blades	p. 26
Real Performance Curve	p. 28
Degree of Reaction	p. 29
Operating Conditions	p. 32
Compressor Inlets	p. 37
Inlet Guide Vanes	p. 37
Influence of Prerotation on Pressure Ratio	p. 40
Design of IGVs	p. 41
The Inducer	p. 49
Calculation of the Inlet	p. 50
Determination of the Inducer Shroud Radius	p. 51
Optimum Incidence Angle	p. 53
Inducer Choking Mass Flow	p. 56
Radial Impeller Flow Calculation	p. 61
Inviscid Impeller Flow Calculation	p. 63
Meridional Velocity Calculation	p. 63
Blade to Blade Velocity Calculation	p. 66
Optimal Velocity Distribution	p. 68
3D Impeller Flow	p. 73
3D Inviscid Flow	p. 73
Boundary Layers	p. 76
Secondary Flows	p. 78
Shrouded-unshrouded	p. 82
Full 3D Geometries	p. 84
Performance Predictions	p. 88
Flow in Divergent Channels	p. 88
Impeller Diffusion Model	p. 90
Two-zone Flow Model	p. 94
Calculation of Average Flow Conditions	p. 101
Influence of the Wake/let Velocity Ratio v on Impeller Performance	p. 102

Slip Factor	p. 104
Disk Friction	p. 108
The Diffuser	p. 113
Vaneless Diffusers	p. 116
One-dimensional Calculation	p. 117
Circumferential Distortion	p. 122
Three-dimensional Flow Calculation	p. 125
Vaned Diffusers	p. 131
Curved Vane Diffusers	p. 131
Channel Diffusers	p. 135
The Vaneless and Semi-vaneless Space	p. 136
The Diffuser Channel	p. 143
Detailed Geometry Design	p. 147
Inverse Design Methods	p. 147
Analytical Inverse Design Methods	p. 148
Inverse Design by CFD	p. 152
Optimization Systems	p. 156
Parameterized Definition of the Impeller Geometry	p. 157
Search Mechanisms	p. 159
Gradient Methods	p. 160
Zero-order Search Mechanisms	p. 161
Evolutionary Methods	p. 161
Metamodel Assisted Optimization	p. 164
Muitiobjective and Constraint Optimization	p. 170
Muitiobjective Ranking	p. 170
Constraints	p. 172
Muitiobjective Design of Centrifugal Impellers	p. 173
Multipoint Optimization	p. 175
Design of a Low Solidity Diffuser	p. 175
Multipoint Impeller Design	p. 177
Robust Optimization	p. 181
Volutes	p. 185
Inlet Volutes	p. 185
Inlet Bends	p. 186
Inlet Volutes	p. 190
Vaned Inlet Volutes	p. 193
Tangential Inlet Volute	p. 194
Outlet Volutes	p. 196
Volute Flow Model	p. 196
Main Geometrical Parameters	p. 197

Detailed 3D Flow Structure in Volute	p. 200
Design Mass Flow Operation	p. 201
Lower than Design Mass Flow	p. 204
Higher than Design Mass Flow	p. 205
Central Elliptic Volute	p. 208
High Mass Flow Measurements	p. 210
Medium and Low Mass Flow Measurements	p. 215
Volute Outlet Measurements	p. 215
Internal Rectangular Volute	p. 215
High Mass Flow Measurements	p. 216
Medium Mass Flow Measurements	p. 218
Low Mass Flow Measurements	p. 219
Volute Cross Sectional Shape	p. 221
Volute Performance	p. 222
Experimental Results	p. 224
Performance Predictions	p. 225
Detailed Evaluation of Volute Loss Model	p. 228
3D analysis of Volute Flow	p. 230
Volute-diffuser Optimization	p. 231
Non-axisymmetric Diffuser	p. 233
Increased Diffuser Exit Width	p. 234
Impeller Response to Outlet Distortion	p. 237
Experimental Observations	p. 238
Theoretical Predictions	p. 242
1D Model	p. 244
CFD- Mixing Plane Approach	p. 245
3D Unsteady Flow Calculations	p. 247
Impeller with 20 Full Blades	p. 248
Impeller with Splitter Vanes	p. 249
Inlet and Outlet Flow Distortion	p. 249
Parametric Study	p. 253
Frozen Rotor Approach	p. 254
Radial Forces	p. 258
Experimental Observations	p. 258
Computation of Radial Forces	p. 263
Off-design Performance Prediction	p. 267
Impeller Response Model	p. 268
Diffuser Response Model	p. 269
Volute Flow Calculation	p. 269
Impeller Outlet Pressure Distribution	p. 272

Evaluation and Conclusion	p. 273
Stability and Range	p. 275
Distinction Between Different Types of Rotating Stall	p. 276
Vaneless Diffuser Rotating Stall	p. 280
Theoretical Stability Calculation	p. 284
Comparison with Experiments	p. 287
Influence of the Diffuser Inlet Shape and Pinching	p. 289
Abrupt Impeller Rotating Stall	p. 296
Theoretical Prediction Models	p. 297
Comparison with Experimental Results	p. 300
Progressive Impeller Rotating Stall	p. 301
Experimental Observations	p. 301
Vaned Diffuser Rotating Stall	p. 307
Return Channel Rotating Stall	p. 314
Surge	p. 314
Lumped Parameter Surge Model	p. 316
Mild Versus Deep Surge	p. 321
An Alternative Surge Prediction Model	p. 325
Operating Range	p. 329
Active Surge Control	p. 330
Throttle Valve Control	p. 331
Variable Plenum Control	p. 333
Active Magnetic Bearings	p. 335
Close-coupled Resistance	p. 336
Bypass Valves	p. 337
Increased Impeller Stability	p. 340
Dual Entry Compressors	p. 342
Casing Treatment	p. 344
Enhanced Vaned Diffuser Stability	p. 347
Impeller-diffuser Matching	p. 351
Enhanced Vaneless Diffuser Stability	p. 354
Low Solidity Vaned Diffusers	p. 356
Half-height Vanes	p. 359
Rotating Vaneless Diffusers	p. 359
Bibliography	p. 363
Index	p. 385

Table of Contents provided by Blackwell's Book Services and R.R. Bowker. Used with permission.