

**ARCHITECTURE AND
CLIMATE — An Introduction — 11**

**THE GLOBAL CLIMATE —
Basics and Overview — 15**

- Key Climatic Concepts and Terms — 15
 - Temperatures — 15
 - Winds and Their Formation — 20
 - Humidity — 22
- The Five Global Climate Zones — 23
- Climate Perception — 38
 - Thermal Comfort — 38
 - Heat (Heat Index) — 39
 - Cold (Wind Chill) — 41

**Building in the
TROPICAL ZONE — 45**

- Climatic Conditions — 48
- Topographical Site Selection and
Building Orientation — 49
- Natural, Local (Building) Materials — 51
- Architectural Approach in the
Tropical Zone — 53
- Building Disposition — 53
 - Moisture Protection through
Elevated Structures — 53
 - Ventilation through Elevated
Structures — 56
- Openings and Ventilation Strategies — 58
 - Ventilation Needs — 58
 - Building Orientation and Position
of Openings — 60
 - Dimensions of Openings — 64
 - Ventilation through Building
Volume — 66
 - Ventilation through Materiality — 68

- Ventilation through Roofs and
Ventilation Accelerators — 69
- Building Design — 74
 - Settlement Layout — 74
 - Elevated and Framed Structures — 77
 - Roof Design — 84
 - Wall Design — 86
- Material Selection — 87
 - Water Resistance — 88
 - Rot Resistance — 90
 - Thermal Mass — 91
- Addressing Solar Heat Gain — 92
 - Heat Reduction through
Roof Pitch — 93
 - Thermally Insulating Materials — 94
 - Heat Regulation through Color — 95
- Shading and Planting — 96
 - Vegetative Funnel — 96
 - Vegetative Shading — 100
- Typical Architectural Elements of
the Tropical Zone — 101
 - Overhangs — 102
 - Verandas — 102

**Building in the
ARID ZONE — 107**

- Climatic Conditions — 110
- Topographical Site Selection and
Building Disposition — 112
- Natural, Local (Building) Materials — 116
- Architectural Approach in the
Arid Zone — 119
- Addressing Solar Heat Gain — 120
 - Regulation through Building
Orientation — 121
 - Regulation through Building
Density — 124

- Regulation through Color and Light Energy — 126
- Material Selection and Behavior — 128
 - Thermal Mass Energy Storage — 128
 - Composite Construction Applications — 131
 - Climate-Reactive, Responsive Materials — 136
- Building Design — 140
 - Building Shape — 140
 - Building Volume — 143
 - Building Dimensions and Room Use by Time of Day — 145
 - Seasonal Room Use — 148
- Openings and Ventilation Strategies — 154
 - Orientation of Openings — 155
 - Ventilation through Building Density — 156
 - Ventilation through Building Volume — 161
 - Ventilation through Building Openings — 166
 - Dimensions of Openings — 170
- Shading and Planting — 171
 - Shading through Building Shape and Height — 172
 - Shading through Alignment — 175
 - Shading through Urban Density — 178
 - Shading through Shading Elements — 181
 - Shading through Vegetation — 184
- Natural Cooling and Thermodynamics — 185
 - Thermal Conduction — 186

- Thermal Radiation and the Role of Light — 190
 - Convection 1: Evaporation through Room Air or Thermal Conduction — 198
 - Convection 2: Evaporation through Vegetation — 207
- Architectural Cooling Systems — 210
 - Solar Chimney — 210
 - Badgir — 212
 - Dome — 219
 - Icehouse — 224

**Building in the
TEMPERATE ZONE — 229**

- Climatic Conditions — 232
- Topographical Site Selection and Building Disposition — 234
 - Under/Against an Overhang or Cliff — 234
 - In/Under the Ground or Mountain — 236
 - In Flatland areas — 240
- Natural, Local (Building) Materials — 241
- Architectural Approach in the Temperate Zone — 243
- Addressing Solar Heat Gain — 243
 - Reduction through Urban Density — 244
 - Regulation through Building Alignment — 247
- Building Design and Ventilation Strategies — 251
 - Mobile Dwellings — 251
 - Fixed Buildings Above Ground — 258
 - Fixed Buildings Underground — 263

- Fixed Buildings: Built into a Mountain — 272
 - Migration within Buildings — 276
- Material Selection and Construction Techniques — 278
 - Homogeneous Material Use — 279
 - Heterogeneous Material Use (Composite System) — 282
 - Additive Materials (Using the Same Material) — 284
 - Climate-Reactive, Responsive Materials — 285
- Shading and Planting — 288
 - Shading through Topography — 289
 - Shading through Vegetation — 290
 - Shading through Architectural Elements — 292
- Natural Heating and Cooling Processes — 294
 - Heat Exchange — 294
 - Ventilation Systems — 297

**Building in the
CONTINENTAL ZONE — 303**

- Climatic Conditions — 306
- Topographical Site Selection — 306
 - Migration between Two Buildings — 307
- Natural, Local (Building) Materials — 308
- Architectural Approach in the Continental Zone — 310
- Building Disposition — 310
 - Elevated Buildings — 311
 - Ground-Level Buildings — 311
 - Subterranean and Semi-Subterranean Buildings — 314
- Solar Heat Gain and Building Orientation — 315

- Building Design — 316
 - Heat Conservation through High Settlement Density — 318
- Mobile Dwellings — 319
 - Heat Conservation through Composite Construction — 322
 - Heat Conservation through Log Construction — 326
- Material Selection — 329
 - Material Properties of Wood — 329
 - Types of Wood and Their Application — 330
 - Material Properties of Turf — 333
 - Types of Turf and Extraction — 334
- Openings and Ventilation Strategies — 336
- Planting — 338
- Typical Architectural Elements of the Continental Zone — 338

**Building in the
POLAR ZONE — 341**

- Climatic Conditions and Vegetation — 344
- Topographical Site Selection — 346
- Natural, Local (Building) Materials — 347
- Architectural Approach in the Polar Zone — 348
- Building Disposition and Orientation — 349
- Building Design and Typical Architectural Elements — 350
 - Urban and Structural Density of Snow Houses — 351
 - Modularity in Construction and Thermal Energy Optimization — 354

Material Selection — 357
Openings and Ventilation
Strategies — 360

EPILOG — 365

Sources and References — 369

Images – Sources and References — 391

Index — 401

Acknowledgments — 415

Imprint — 416