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Governance -- 2.3 Information and Communications Technology and Systems -- 2.4 Technology and Sustainability -- 2.5 Demographic Trends -- 2.5.1 Urbanization -- 2.5.2 Urbanization and Sustainable Engineering -- 2.5.3 Age-Related Demographic Issues -- 2.5.4 Demographics and Risk -- Exercises -- Annotated Bibliography -- Chapter 3 COMPLEXITY -- 3.1 Complexity -- 3.2 Simple versus Complex Systems -- 3.3 Different Forms of Complexity -- 3.4 Understanding Complexity -- 3.5 Models, Ideology, and Complexity -- Exercises -- Annotated Bibliography -- Chapter 4 SUSTAINABILITY -- 4.1 Introduction -- 4.2 Sustainable Development -- 4.2.1 Pillars of Sustainable Development -- 4.2.2 Sustainability as Myth -- 4.3 Sustainability and Resources -- 4.4 From Sustainability to Sustainable Engineering -- 4.5 Sustainability and Global States -- Exercises -- Annotated Bibliography -- Chapter 5 HOMO FABER: HUMAN HISTORY AND TECHNOLOGY -- 5.1 Introduction -- 5.2 The Railroad as Technology System -- 5.3 Technology Clusters -- Exercises -- Annotated Bibliography -- Chapter 6 CHARACTERISTICS OF TECHNOLOGY -- 6.1 Introduction -- 6.2 Product Design -- 6.3 Behavior of Technological Systems -- 6.4 The Three Levels of Technology Systems. 6.5 Concluding Observations -- Exercises -- Annotated Bibliography -- Chapter 7 INDUSTRIAL ECOLOGY -- 7.1 Introduction -- 7.2 Industrial Ecology -- 7.3 Life Cycle Assessment -- 7.4 Streamlined LCA -- 7.5 Systems Engineering -- Exercises -- Annotated Bibliography -- Chapter 8 THE FIVE HORSEMEN: EMERGING TECHNOLOGIES -- 8.1 Introduction -- 8.2 The Five Horsemen -- 8.3 The Human as Design Space -- Exercises -- Annotated Bibliography -- Chapter 9 GREEN CHEMISTRY -- 9.1 Introduction -- 9.2 The CFC Case Study -- 9.3 Antimicrobials and Pharmaceuticals as Earth Systems -- 9.4 Policy Implications -- Exercises -- Annotated Bibliography -- Chapter 10 SUSTAINABLE ENGINEERING: INFORMATION AND COMMUNICATION TECHNOLOGY -- 10.1 Introduction -- 10.2 Framing ICT -- 10.3 Infrastructure Operations -- 10.4 Services -- 10.5 The Virtualization of Work, Digital Nomads, and the Triple Bottom Line -- 10.6 Virtualization of Work and the Evolution of Institutional Complexity -- 10.7 Conclusion -- Exercises -- Annotated Bibliography -- Chapter 11 THE FIVE HORSEMEN, MILITARY OPERATIONS, AND NATIONAL SECURITY -- 11.1 Introduction -- 11.2 Thinking about National Security -- Case 1: Cyborg Insects and Other Surveillance Devices -- Case 2: Telepathic Helmets -- Case 3: Lethal Autonomous Robots -- 11.3 Concluding Thoughts -- Exercises -- Annotated Bibliography -- Chapter 12 THE MACROETHICS OF SUSTAINABLE ENGINEERING -- 12.1 Introduction -- 12.2 Framing Ethics -- 12.3 The Challenge of Macroethics -- Exercises -- Annotated Bibliography -- Chapter 13 THE ARAL SEA, THE EVERGLADES, AND ADAPTIVE MANAGEMENT -- 13.1 Introduction: Adaptive Management -- 13.2 The Aral Sea -- 13.3 The Florida Everglades -- 13.4 Themes -- 13.5 Adaptive Management Principles -- Exercises -- Annotated Bibliography -- Chapter 14 EARTH SYSTEMS ENGINEERING AND MANAGEMENT: SUSTAINABLE ENGINEERING AT A PLANETARY SCALE. 14.1 Introduction -- 14.2 Geoengineering -- 14.3 Urban Design and Management, and High Modernism -- 14.4 Theoretical ESEM Principles -- 14.5 ESEM Governance Principles -- 14.6 ESEM Design and Management Principles -- 14.7 Sustainable Engineering, ESEM, and the Final Principle -- Exercises -- Annotated Bibliography -- Chapter 15 THE ENGINEER AS LEADER -- 15.1 Introduction -- 15.2 Attitude and Preparation -- 15.3 Lead by Following -- 15.4 Personal Characteristics -- Exercises -- Appendix A: Introduction to Sustainable Engineering

Sommario/riassunto

The Theory and Practice of Sustainable Engineering is appropriate to use in sustainable engineering classes for both majors and non-majors. This textbook was designed as the basis for a course in itself, but it can be used to provide modules in existing courses, or as a supplementary text in sustainable engineering, green engineering, industrial ecology, sustainability law and policy, and environmental courses. Sustainable engineering is learning how to engineer responsibly and professionally in the Anthropocene: the Age of the Human. This textbook sketches out the cultural, social, institutional, and environmental context within which engineering and, more broadly, technology systems are now situated. It provides frameworks to facilitate understanding, communication, and the solving of highly complex problems with significant technological dimensions all in the name of generating more capable professionals competent in their chosen field, who are able to integrate other disciplines to address complex adaptive systems.
