CONTENTS

Preface v

Part I
AN EMERGING SYNTHESIS

1. INTRODUCTION 3

Nuclear Systematics • Reaction Linkages • Historical Developments • Emerging Perspective

2. NUCLEAR PROCESSES 17

Fission: Neutron Yield, Energy Yield, Neutron Spectrum • Spallation: Neutron Yield, Energy Yield, Neutron Spectrum • Fusion: Neutron Yield, Energy Yield, Neutron Spectra • Neutron Multiplication • Reaction Rates • Nuclear Cross Sections

3. REACTION AND REACTOR SYSTEMATICS 37

Reaction Notation • Reaction Linkages • Reactor Representations • Nuclear Symbiosis • Back-End Fuel Cycle • Fuel Rejuvenation

Part II
SPALLATION–FISSION INTEGRATION

4. THE SPALLATION–FISSION SYMBIONT 63

System Description • Nuclear Fuel Balance • Fuel Self-Sufficiency • Power Balance • Power Generation and Fuel Self-Sufficiency • Fission and Beam Power • Enriched Fuel Supply • Extended Fuel Flow

5. NUCLEAR FUEL TRAJECTORIES 85

Stockpile Inventory • Simplified Trajectory • Discontinuous Trajectories • Trajectory Dynamics • General Trajectory Characterization • Trajectory Itemization • Cycle Dependencies • Trajectory Parametrization

Part III
(D–T) FUSION–FISSION INTEGRATION

6. THE (D–T) FUSION–FISSION SYMBIONT 109

System Description • Isotope Systematics • Fuel Self-Sufficiency • Core and Blanket Power • System Power

7. FISSILE–FUSILE FUEL TRAJECTORIES 127

System Characterization • Fuel Trajectory Core Components • Fuel Trajectory Blanket Components • Symbiont Fissile and Fusile Trajectories • Tritium Trajectory Formulation • Tritium Trajectory Parametrization • Fissile Fuel Trajectory Characterization

8. THE (D–T) FUSION–FISSION HYBRID 151

System Description • Isotope Flow Options • The Self-Sufficient ^{6}Li Hybrid • The ^{6}Li-Hybrid Breeder • The ^{7}Li-Hybrid • The Natural-Li Hybrid • The T Hybrid • Tritium Trajectory • Fissile Trajectory • Hybrid Power Balance

Part IV
THE BROADER PERSPECTIVE

9. THE RECEDING HORIZON 179

D–D Fusion • Advanced Fusion Fuels • Fusion Satellite Reactors • Fusion Parent–Satellite Power • Fission Satellite System • The Synergetic Ideal

10. THE EMERGING PERSPECTIVE 197

Tradition and Innovation • Nucleonics and Systematics • Nuclear Catalysis and Mass–Energy Sustainability • The Nuclear Energy Continuum • An Expanded Perspective • Synergism Revisited

APPENDIX A: Bibliography 209

APPENDIX B: Nuclear Reaction Characterization 215

APPENDIX C: Equivalent Fuel Concept 223

APPENDIX D: Energy Flow Characterization 229

Index 237