

CONTENTS

Preface	x1
1. Introduction to Transport Theory	
1.1. The Physical Process of Transport Theory	1
1.2. The Concept of Cross Sections	2
1.3. The Scattering Law	4
1.4. Types of Transport Theory	4
1.5. History of Invariant Imbedding Theory	5
1.6. Summary of the Book	6
2. Basic Invariant Imbedding Concepts	
2.1. Introduction	7
2.2. Basic Definitions	7
2.3. The Classical Method	7
2.4. The Invariant Imbedding Approach	11
2.5. The Internal Functions	14
2.6. Exercises	15
3. Albedo Theory: Functional Form	
3.1. Introduction	17
3.2. Basic Definitions	17
3.3. Five Contributing Terms	18
3.4. Special Cases	21
3.5. Exercises	23
4. Scattering Matrix Concepts	
4.1. Introduction	25
4.2. Functional Forms	25
4.3. Matrix Forms	26
4.4. Exercises	30
5. Albedo Theory: Discrete Form	
5.1. Introduction	31
5.2. Discrete Reflection Formulation	31
5.3. Single Scattering Removal	34
5.4. Extensions of the Albedo Theory	37
5.5. Computational Considerations	38
5.6. Exercises	38
6. Transmission Theory	
6.1. Introduction	39
6.2. Basic Definitions	39
6.3. Three Contributing Terms	39

6.4. Factoring of the Transmission Equation	42
6.5. Approximation Theory	44
6.6. Discrete Formulation	44
6.7. A Special Case	46
6.8. Computational Considerations	47
6.9. Exercises	48
7. Escape Function Concepts	
7.1. Introduction	49
7.2. Definitions	49
7.3. Derivation of the Escape Function	50
7.4. Factoring of the Escape Formulation	54
7.5. The Discrete Formulation	56
7.6. A Special Case	58
7.7. Exercises	59
8. The Monoenergetic Case	
8.1. Introduction	61
8.2. Reduction to the Monoenergetic Equations	61
8.3. Homogeneous Media with Isotropic Scattering	62
8.4. The Calculational Forms	64
8.5. The “Blackness Coefficient” Problem	65
8.6. The Escape Probability Problem	68
8.7. The Critical Slab Problem	70
8.8. Multiple Slab Problems	75
8.9. Disadvantage Factor Problem	77
8.10. The Semiinfinite Media Problem	82
8.11. References to Computed Results	83
8.12. Exercises	83
9. Extensions to Multiparticle Theory	
9.1. Introduction	85
9.2. Basic Definitions	85
9.3. Albedo Derivation	86
9.4. The Transmission Result	87
9.5. The Unscattered Contributions	88
9.6. An Example: The Capture Gamma Shielding Problem	91
9.7. The Discrete Forms	93
9.8. Internal Source Problems	95
9.9. Exercises	95
10. The Special Case of Photon Transport	
10.1. Introduction	97
10.2. The Cross Sections for Photons	97
10.3. The Albedo for Photons	104
10.4. Other Photon Results	106
10.5. Exercises	107

11. Curved Geometry Considerations	
11.1. Introduction	109
11.2. General Curved Geometry Approaches	109
11.3. The Case of Spherical Geometry	110
11.4. The Solution of the Spherical Problem	114
11.5. Extensions to Other Curved Geometries	118
11.6. Exercises	119
12. Appendix: Numerical Analysis Considerations	
12.1. Ordinary Differential Equations	121
12.2. Runge–Kutta–Gill Method	122
12.3. Runge–Kutta–Merson Method	123
12.4. Example Calculations	124
References	126
Index	129