



# Contents

<b>Abstract</b>	vii
<b>Kurzfassung</b>	ix
<b>Glossary</b>	xiii
<b>1 Introduction</b>	1
1.1 Why Spheroidal Structures? . . . . .	1
1.2 Outline of the Thesis. . . . .	4
1.3 Contributions. . . . .	4
<b>2 Wire Antenna Conformation</b>	7
2.1 Conformal Antennas. . . . .	7
2.2 Introduction to Elliptical Parameters. . . . .	9
2.3 Conformation Methods. . . . .	10
2.3.1.1 Conformation Using Closed Form Formulas. . . . .	11
2.3.1.2 Spherical Trigonometry. . . . .	14
2.3.2 Conformation Using Numerical Integration. . . . .	15
2.3.3 Conformation Using Elemental Segments. . . . .	17
2.3.3.1 Spheroidal Geometry. . . . .	17
2.3.3.2 Spheroidal Geodesic Computation. . . . .	20
2.3.3.3 Spiral Antenna Conformation. . . . .	21
2.4 Conclusion. . . . .	23
<b>3 Method of Moments Analysis of Spheroidal Wire Antennas</b>	25
3.1 Thin Wire Approximation. . . . .	25
3.2 Unit Tangent Vector and Wire Length. . . . .	27
3.3 Method of Moments Solution. . . . .	28
3.4 Implementation. . . . .	32
3.5 Results. . . . .	33
3.6 Conclusion. . . . .	38



<b>4 Wire Antenna Analysis in Multi-layer Spheroidal Structure</b>	<b>39</b>
4.1 Spheroidal Coordinate System.....	39
4.2 Dyadic Green's Function and Vectors.....	41
4.3 MoM Derivation of Spiral Antenna in Multilayer Media.....	42
4.4 Implementation.....	46
4.5 Dyadic Green's Function Divergence and Verification.....	47
4.6 Conclusion.....	50
<b>5 Transient Field in Multilayer Spherical Media Energized by Spherical Waves' Sources</b>	<b>51</b>
5.1 Introduction.....	51
5.2 Frequency Domain Solution.....	53
5.3 Transient Response.....	56
5.4 Path Tracing.....	61
5.5 Transient Fields in Other Layers.....	63
5.6 Results and Discussion.....	64
5.7 Conclusion.....	71
<b>6 FDTD Modeling and Formulation of closed Spheroidal Structures</b>	<b>73</b>
6.1 Introduction.....	73
6.2 Modeling and Derivation.....	74
6.3 FDTD Grid's Singularities.....	79
6.4 Results and Discussion.....	84
6.5 Conclusion.....	90
<b>7 Finite Difference Time Domain Method for Unbounded Spheroidal Space</b>	<b>91</b>
7.1 Spheroidal Absorbing Boundary Condition.....	91
7.2 Numerical Stability.....	96
7.3 Cell Size.....	99
7.4 Results and Discussion.....	100
7.5 Conclusion.....	107
<b>Appendix A</b>	<b>109</b>
<b>Appendix B</b>	<b>111</b>
<b>Appendix C</b>	<b>121</b>
<b>Appendix D</b>	<b>131</b>
<b>Bibliography</b>	<b>133</b>