

## List of Figures

<b>Figure 2.1</b>	(a) Geometry of helical antenna; (b) Unrolled turn of helical antenna.....	6
<b>Figure 2.2</b>	Instantaneous charge distribution for transmission modes: (a) The lowest-order mode ( $T_0$ ); (b) The second-order mode ( $T_1$ ) .....	6
<b>Figure 2.3</b>	Radiation patterns of helix: (a) Normal mode; (b) Axial mode .....	8
<b>Figure 2.4</b>	Approximating the geometry of normal-mode helix .....	12
<b>Figure 2.5</b>	Measured current distribution on axial-mode helix [5] .....	12
<b>Figure 2.6</b>	Gain of helix for different lengths as function of normalized circumference ( $C_1$ ) [9] .....	17
<b>Figure 2.7</b>	Peak gain of various diameter as $D$ and $\alpha$ varied (circles), $D$ fixed and $\alpha$ varied (triangle) [8]. .....	17
<b>Figure 2.8</b>	Gain versus frequency of 30.8-inch length and 4.3-inch diameter helix for different pitch angles [8]. .....	19
<b>Figure 2.9</b>	Gain versus frequency for 5 to 35-turn helical antennas with 4.23-inch diameter [8] .....	20
<b>Figure 2.10</b>	Radiation patterns for various helical turns of helices with $\alpha = 12^\circ$ and $C = 10\text{cm}$ . at 3 GHz [12]. .....	20
<b>Figure 2.11</b>	Tapered helical antenna configuration.[11]. .....	23
<b>Figure 2.12</b>	$\frac{1}{2}$ turn half-wavelength printed resonant quadrifilar helix [14]. .....	24
<b>Figure 2.13</b>	Stub-loaded helix configuration [15]. .....	25
<b>Figure 2.14</b>	Monopole-helix antenna [16]. .....	25
<b>Figure 3.1</b>	Geometry of spherical helix: (a) Fully wound 10-turn helix, (b) Truncated 7-turn helix.....	27
<b>Figure 3.2</b>	Hemispherical helical antenna with 4.5 turns .....	30

<b>Figure 4.1</b>	Computed radiation patterns, (————) $G_q$ and (.....) $G_f$ , for truncated spherical helices with $C = 1.25l$ , $N = 10$ , and actual number of turns (a) $n = 9$ , (b) $n = 7$ , (c) $n = 5$ , and (d) $n = 3$ .....	38
<b>Figure 4.2</b>	Variations of phase difference between $q$ and $f$ components of electric field versus theta for several values of $n$ .....	39
<b>Figure 4.3</b>	Variations of axial ratio in the $q = 0^\circ$ direction versus actual number of turns for truncated spherical helices with $C = 1.25l$ and $N = 10$ .....	40
<b>Figure 4.4</b>	Variations of directivity versus actual number of turns for truncated spherical helices with $C = 1.25l$ and $N = 10$ .....	40
<b>Figure 4.5</b>	Variations of axial ratio in the $q = 0^\circ$ direction versus actual number of turns for spherical helices with $C = 1.25l$ and (a) $N = 7$ , (b) $N = 4$ .....	41
<b>Figure 4.6</b>	Variations of directivity versus actual number of turns for spherical helices with $C = 1.25l$ and (a) $N = 7$ , (b) $N = 4$ .....	42
<b>Figure 4.7</b>	Geometry of double spherical helix. The lower sphere has 7 turns, while the upper one has 4 turns.....	44
<b>Figure 4.8</b>	Comparison of computed directivities of the spherical and double spherical helices. Both helices have a radius of 0.0254 m.....	44
<b>Figure 4.9</b>	Calculated radiation patterns of double spherical helix at $f = 1.88$ GHz....	45
<b>Figure 4.10</b>	Calculated axial ratio of double spherical helix at $f = 1.88$ GHz.....	45
<b>Figure 4.11</b>	Calculated axial ratio versus frequency for double spherical helix with a diameter of 0.0508 m.....	46
<b>Figure 4.12</b>	Comparison of directivity versus frequency for various hemispherical helices.....	48
<b>Figure 4.13</b>	Comparison of axial ratio in $q = 0^\circ$ direction versus frequency for various hemispherical helices.....	48
<b>Figure 4.14</b>	Input impedance versus frequency for 3-turn hemispherical helix with a diameter of 0.04 m.....	50
<b>Figure 4.15</b>	Input impedance versus frequency for 4.5-turn hemispherical helix with a diameter of 0.04 m.....	50

<b>Figure 4.16</b> Input impedance versus frequency for 7-turn hemispherical helix with a diameter of 0.04 m. ....	51
<b>Figure 4.17</b> Input impedance versus frequency for 9-turn hemispherical helix with a diameter of 0.04 m. ....	51
<b>Figure 4.18</b> Far-field patterns at $f = 2.84$ GHz for a 4.5-turn hemispherical helix with a diameter of 0.04 m mounted over $10 \times 10$ cm <sup>2</sup> ground plane. ....	52
<b>Figure 4.19</b> Axial ratio versus frequency for 4.5-turn hemispherical helix with a diameter of 0.04 m. ....	54
<b>Figure 4.20</b> Computed radiation patterns, (————) $G_q$ and (.....) $G_f$ , for 4.5-turn hemispherical helices with normalized circumference of $1.19\lambda$ , (a) $f = 2.84$ GHz, (b) $f = 5.0$ GHz, (c) $f = 7.0$ GHz, and (d) $f = 9.0$ GHz. ....	55
<b>Figure 4.21</b> Axial ratios for 4.5-turn hemispherical helices with normalized circumference of $1.19\lambda$ , (a) $f = 2.84$ GHz, (b) $f = 5.0$ GHz, (c) $f = 7.0$ GHz, and (d) $f = 9.0$ GHz. ....	56
<b>Figure 5.1</b> (a) Computed and (b) measured radiation patterns for the double spherical helix at $f = 1.85$ GHz. ....	60
<b>Figure 5.2</b> (a) Computed and (b) measured far-field patterns for the hemispherical helix at $f = 2.8$ GHz. ....	61
<b>Figure 5.3</b> Computed axial ratio from measured pattern data for the 4.5-turn hemispherical helix. ....	63