

---

# Contents

---

<b>Preface</b>	<b>viii</b>
<b>Acknowledgments</b>	<b>ix</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Historical observations	1
1.2 Organisation of the book	3
<b>2 Introduction to hybrid-mode feeds</b>	<b>5</b>
2.1 Illumination of a reflector antenna	5
2.2 Focal field of a reflector	10
<b>3 Propagation and radiation characteristics of cylindrical corrugated waveguides</b>	<b>20</b>
3.1 Introduction	20
3.2 Propagation in cylindrical corrugated waveguide	22
3.3 Fields in cylindrical corrugated waveguide	35
3.4 Attenuation in corrugated waveguide	40
3.5 Radiation from corrugated waveguides	43
3.5.1 Introduction	43
3.5.2 Radiation from a circular aperture	45
3.6 Junctions in corrugated waveguides	50
3.7 Multimode corrugated waveguides	54
<b>4 Propagation and radiation characteristics of conical corrugated waveguides</b>	<b>58</b>
4.1 Introduction	58
4.2 Modal characteristics of corrugated conical horns	58
4.3 Radiation from corrugated conical horns by the spherical wave expansion method	65
4.3.1 The spherical wave expansion method	65
4.3.2 Frequency dependence of crosspolar radiation field	68

4.4	Generation of higher order modes	69	7	<b>Rectangular and elliptical corrugated horns</b>	181
4.4.1	Scattering at an abrupt discontinuity	71	7.1	Introduction	181
4.4.2	Higher order mode generation at the throat	73	7.2	Rectangular corrugated horns	181
4.4.3	Mode conversion along a horn with constant flare angle	73	7.2.1	Background	181
4.4.4	Mode conversion along a horn with variable flare angle	78	7.2.2	Two-walled rectangular corrugated waveguide	183
4.5	Radiation from corrugated horns by the Kirchhoff–Huygen method	86	7.2.3	Four-wall rectangular corrugated waveguide	188
4.6	Comparison of predicted and measured radiation patterns	90	7.2.4	Radiation characteristics of rectangular corrugated horns	190
4.7	Radiation from corrugated horns by cylindrical waveguide approximation	90	7.3	Elliptical corrugated horns	193
4.8	Radiation from conical corrugated horns by means of the Laguerre–Gaussian expansion method	95		<b>Appendix</b>	199
5	<b>Design of cylindrical and conical corrugated horns</b>	97		<b>Bibliography</b>	213
5.1	Introduction	97		<b>Programs</b>	222
5.2	Copolar radiation characteristics	100		<b>Index</b>	227
5.3	Crosspolar radiation characteristics	114			
5.4	Flare section of horn	122			
5.5	Throat region of horn	128			
5.6	Gain and directivity	135			
5.7	Efficiency when used as a feed for a reflector	137			
5.8	Horn design	141			
5.8.1	Large aperture, narrow flare angle horns	141			
5.8.2	Small aperture horns	143			
5.8.3	Wide flare angle horns	145			
5.8.4	Multimode horns	150			
5.8.5	Broadband horns	153			
5.8.6	Multifrequency horns	154			
5.8.7	Compact horns	155			
5.9	Numerical prediction of performance	156			
5.9.1	Propagation characteristics	157			
5.9.2	Radiation characteristics	160			
6	<b>Manufacture and testing of corrugated horns</b>	163			
6.1	Manufacture of corrugated horns	163			
6.2	Testing of corrugated horns	169			
6.2.1	Introduction	169			
6.2.2	Types of test range	171			
6.2.3	Anechoic chamber design for low crosspolarisation horn measurement	172			
6.2.4	Assessment of test range performance	175			
6.2.5	Measurement of copolar and crosspolar patterns	177			
6.2.6	Measurement of phase patterns and gain	180			