

1. Record Nr.	UNINA9910140639903321
Autore	Chen Yikai <1984->
Titolo	Charasteristic modes : theory and applications in antenna engineering / / Yikai Chen, Chao-Fu Wang
Pubbl/distr/stampa	Hoboken, New Jersey : , : John Wiley & Sons, Inc., , [2015] ©2015
ISBN	1-119-03889-8 1-119-03890-1
Descrizione fisica	1 online resource (294 p.)
Classificazione	TEC008000
Disciplina	621.3848
Soggetti	Radar - Automatic detection Antennas (Electronics) - Automatic control
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references at the end of each chapters and index.
Nota di contenuto	-- List of Figures ix -- List of Tables xvii -- Preface xix -- 1 Introduction 1 -- 1.1 Backgrounds 1 -- 1.2 An Introduction to Characteristic Mode Theory 3 -- 1.2.1 Traditional Modal Analysis in Antenna Engineering 3 -- 1.2.2 Definition of Characteristic Modes 6 -- 1.2.3 Primary Properties of Characteristic Modes 7 -- 1.2.4 Variants of Characteristic Modes 7 -- 1.3 Characteristic Modes in Antenna Engineering 10 -- 1.3.1 Pioneering CM Studies (1965 / 1990) 12 -- 1.3.2 Recent CM Developments (1991 / 2014) 13 -- 1.4 Characteristic Modes in Scattering Computation 19 -- 1.5 Outline of this Book 20 -- References 22 -- 2 Characteristic Mode Theory for PEC Bodies 37 -- 2.1 Backgrounds 37 -- 2.2 Surface Integral Equations 39 -- 2.2.1 Maxwell's Equations 39 -- 2.2.2 Electromagnetic Boundary Condition 39 -- 2.2.3 Magnetic Vector Potential and Electric Scalar Potential 40 -- 2.2.4 Electric Field Integral Equation 41 -- 2.2.5 Magnetic Field Integral Equation 43 -- 2.3 Method of Moments 43 -- 2.4 EFIE Based CM Formulation 47 -- 2.4.1 Conventional Derivation 47 -- 2.4.2 Poynting's Theorem Based Derivation 48 -- 2.4.3 Othogonality of Characteristic Modes 49 -- 2.4.4 Physical Interpretation of Eigenvalues 51 -- 2.4.5 Physical Interpretation of Modal Significances 52 -- 2.4.6 Physical Interpretation of Characteristic Angles 54 -- 2.5 MFIE Based CM

Formulation 55 -- 2.5.1 MFIE Based CM Formulation 55 -- 2.5.2  
Approximate MFIE-Based CM Formulation 57 -- 2.6 CFIE-Based CM  
Formulation 59 -- 2.7 Applicability of the CM Formulations 60 -- 2.7.1  
Closed and Open Objects 60 -- 2.7.2 Electrically Small and Large  
Problems 60 -- 2.8 Computation of Characteristic Modes 61 -- 2.8.1  
Solution of Generalized Eigenvalue Equation 61 -- 2.8.2 Characteristic  
Mode Tracking 65 -- 2.9 Numerical Examples 70 -- 2.9.1 PEC Sphere  
70 -- 2.9.2 Rectangular PEC Patch 81 -- 2.9.3 Numerical Aspects of  
Mesh Density 82 -- 2.10 A First Glance on CM Excitations 88 -- 2.11  
Summary 95 -- References 95 -- 3 Characteristic Mode Theory for  
Antennas in Multilayered Medium 99.  
3.1 Backgrounds 99 -- 3.2 CM Formulation for PEC Structures in  
Multilayered Medium 103 -- 3.3 Relationship Between Cavity Model  
and Characteristic Modes 105 -- 3.4 Physical Investigations on  
Microstrip Patch Antennas 111 -- 3.4.1 Equilateral Triangular Patch  
Antenna 112 -- 3.4.2 Concentric Circular Microstrip Antenna 115 --  
3.4.3 Corner-Truncated Circularly Polarized Antenna 117 -- 3.4.4 Dual  
Band Stacked Microstrip Patch Antenna 120 -- 3.5 Applications to  
Circularly Polarized Microstrip Antenna Design 125 -- 3.5.1 U-Slot  
Microstrip Antenna 126 -- 3.5.2 E-Shaped Microstrip Antenna with Low  
Cross Polarization 131 -- 3.5.3 Summary 138 -- 3.6 Conclusions 139  
-- References 139 -- 4 Characteristic Mode Theory for Dielectric  
Resonators 143 -- 4.1 Backgrounds 143 -- 4.1.1 A Brief Introduction  
to DRA 144 -- 4.1.2 Importance of Modal Analysis and its Challenges  
146 -- 4.1.3 Early Attempts to DRA Modal Analysis Using Characteristic  
Mode Theory 147 -- 4.1.4 Contributions of this Chapter 148 -- 4.2 CM  
Formulations for Dielectric Bodies 149 -- 4.2.1 PMCHWT Surface  
Integral Equations 149 -- 4.2.2 MoM Matrix Equation 152 -- 4.2.3  
Generalized Eigenvalue Equation for Characteristic Electric Current 152  
-- 4.2.4 Important CM Quantities 154 -- 4.2.5 Generalized Eigenvalue  
Equation for Characteristic Magnetic Current 155 -- 4.3 Analysis and  
Design of DRAs Using CM Theory 156 -- 4.3.1 Cylindrical Dielectric  
Resonator Antennas 157 -- 4.3.2 Spherical Dielectric Resonator  
Antennas 164 -- 4.3.3 Rectangular Dielectric Resonator Antennas 170  
-- 4.3.4 Triangular Dielectric Resonator Antennas 175 -- 4.3.5 Notched  
Rectangular Dielectric Resonator Antenna 178 -- 4.4  
Computational Efficiency 181 -- 4.5 Conclusions 181 -- References  
182 -- 5 Characteristic Mode Theory for N-Port Networks 187 -- 5.1  
Backgrounds 187 -- 5.2 Characteristic Mode Formulations For N-Port  
Networks 188 -- 5.3 Reactively Controlled Antenna Array Designs  
Using Characteristic Modes 192 -- 5.3.1 Problem Formulation 192 --  
5.3.2 Design and Optimization Procedure 194.  
5.3.3 Design Examples 199 -- 5.3.4 Efficiency of CM-Based Approach  
202 -- 5.4 Yagi-Uda Antenna Designs Using Characteristic Modes 203  
-- 5.4.1 CM-Based Design Method 204 -- 5.4.2 Design Examples 208  
-- 5.4.3 Efficiency Investigation 212 -- 5.5 Wideband Array Excitation  
Design Using Characteristic Modes 214 -- 5.5.1 Tightly Coupled  
Wideband Arrays 214 -- 5.5.2 Computation of Quasi-Excitations from  
Characteristic Modes 215 -- 5.6 Conclusions 217 -- References 217 --  
6 Platform-Integrated Antenna System Design Using Characteristic  
Modes 221 -- 6.1 Backgrounds 221 -- 6.2 Electrically Small UAV  
Antenna System Design Using Characteristic Modes 223 -- 6.2.1  
Reconfigurable Radiation Pattern Synthesis Using Characteristic Modes  
223 -- 6.2.2 Feeding Designs for the Excitation of the Synthesized  
Currents 235 -- 6.2.3 Experimental Validations 238 -- 6.2.4 Summary  
241 -- 6.3 HF Band Shipboard Antenna System Design Using  
Characteristic Modes 245 -- 6.3.1 CM-Based Broadside Radiation  
Pattern Synthesis 246 -- 6.3.2 Feeding Structure Design 254 -- 6.3.3

---

Sommario/riassunto

"This book examines the characteristic mode (CM) theory for various electromagnetic structures as well as their applications in antenna engineering. The book covers the theoretical developments, numerical implementations, and the applications of the various CM theories. The authors provide antenna scientists and engineers with the theoretical developments, numerical implementations, and design methodologies of the CM theory. The readers will find the basic coverage of all aspects of the CM theory, which provides the background needed when they desire to solve their challenging antenna design problems using the CM theory. This book will cover the following topics in seven chapters: -- A detailed overview of the CM research history and the very important milestones; -- A comprehensive introduction of the CM theories for various electromagnetic structures including: PEC bodies, structures in multilayered medium, dielectric bodies, and N-port networks; -- Numerical implementation of the CM theories and the related algorithms; -- Systematic CM-based approaches to design low frequency platform mounted antenna systems; -- Novel feeding structures to excite the antenna platform as the radiator; -- CM-based microstrip antenna, dielectric resonant antenna, and antenna array designs; -- Experimental verifications illustrating the versatility of the CM theory in antenna engineering"--

---