

# INTRODUCTION TO RADAR SYSTEMS 3RD EDITION

INTRODUCTION TO RADAR SYSTEMS MODERN RADAR SYSTEMS UNDERSTANDING RADAR SYSTEMS RADAR SYSTEMS RADAR SYSTEMS ANALYSIS AND DESIGN USING MATLAB RADAR SYSTEM ANALYSIS AND MODELING RADAR SYSTEMS INTRODUCTION TO RADAR ANALYSIS RADAR SYSTEMS, PEAK DETECTION AND TRACKING MODERN RADAR SYSTEM ANALYSIS FUNDAMENTAL PRINCIPLES OF RADAR KNOWLEDGE BASED RADAR DETECTION, TRACKING AND CLASSIFICATION INTRODUCTION TO RADAR SYSTEMS AN INTRODUCTION TO PASSIVE RADAR, SECOND EDITION RADAR SYSTEMS AND RADIO AIDS TO NAVIGATION FUNDAMENTALS OF MULTISITE RADAR SYSTEMS AIR AND SPACEBORNE RADAR SYSTEMS INTRODUCTION TO RADAR SYSTEMS RADAR SYSTEMS PRINCIPLES MODERN RADAR DETECTION THEORY MERRILL IVAN SKOLNIK HAMISH MEIKLE SIMON KINGSLEY PAUL A. LYNN BASSEM R. MAHAFZA DAVID K. BARTON WEN-QIN WANG BASSEM R. MAHAFZA MICHAEL KOLAWOLE DAVID KNOX BARTON HABIBUR RAHMAN FULVIO GINI MERRILL I SKOLNIK HUGH D. GRIFFITHS A. K. SEN V S CHERNYAK PHILIPPE LACOMME SKOLNIK HAROLD R. RAEMER ANTONIO DE MAIO

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SINCE THE PUBLICATION OF THE SECOND EDITION OF INTRODUCTION TO RADAR SYSTEMS THERE HAS BEEN CONTINUAL DEVELOPMENT OF NEW RADAR CAPABILITIES AND CONTINUAL IMPROVEMENTS TO THE TECHNOLOGY AND PRACTICE OF RADAR THIS GROWTH HAS NECESSITATED THE ADDITION AND UPDATING OF THE FOLLOWING TOPICS FOR THE THIRD EDITION DIGITAL TECHNOLOGY AUTOMATIC DETECTION AND TRACKING DOPPLER TECHNOLOGY AIRBORNE RADAR AND TARGET RECOGNITION THE TOPIC COVERAGE IS ONE OF THE GREAT STRENGTHS OF THE TEXT IN ADDITION TO A THOROUGH REVISION OF TOPICS AND DELETION OF OBSOLETE MATERIAL THE AUTHOR HAS ADDED END OF CHAPTER PROBLEMS TO ENHANCE THE TEACHABILITY OF THIS CLASSIC BOOK IN THE CLASSROOM AS WELL AS FOR SELF STUDY FOR PRACTICING ENGINEERS

THIS ONE OF A KIND BOOK FEATURES 536 ILLUSTRATIONS DRAWN IN MAPLE V THAT OFFER A GREATER UNDERSTANDING OF VARIOUS WAVEFORMS AND OTHER TWO AND THREE DIMENSIONAL FUNCTIONS TO HELP YOU MORE ACCURATELY ANALYZE RADAR SYSTEM PERFORMANCE THE EFFECTS OF PULSE SHAPING ON TRANSMITTER STABILITY AND SPECTRA ARE DISCUSSED A TOPIC WHICH IS BECOMING MORE AND MORE IMPORTANT IN THE AGE OF ELECTROMAGNETIC COMPATIBILITY THE BOOK ADDRESSES THE IMPORTANCE OF LOW ATTENUATION AND REFLECTION BETWEEN THE MAIN RADIO FREQUENCY BLOCKS INCLUDING THE USE OF OVERSIZED WAVEGUIDES FOR LONG RUNS

WHAT IS RADAR WHAT SYSTEMS ARE CURRENTLY IN USE HOW DO THEY WORK UNDERSTANDING RADAR SYSTEMS PROVIDES ENGINEERS AND SCIENTISTS WITH ANSWERS TO THESE CRITICAL QUESTIONS FOCUSING ON ACTUAL RADAR SYSTEMS IN USE TODAY IT S THE PERFECT RESOURCE FOR THOSE JUST ENTERING THE FIELD OR A QUICK REFRESHER FOR EXPERIENCED PRACTITIONERS THE BOOK LEADS READERS THROUGH THE SPECIALIZED LANGUAGE AND CALCULATIONS THAT COMPRISE THE COMPLEX WORLD OF MODERN RADAR ENGINEERING AS SEEN IN DOZENS OF STATE OF THE ART RADAR SYSTEMS THE AUTHORS STRESS PRACTICAL CONCEPTS THAT APPLY TO ALL RADAR KEEPING MATH TO A MINIMUM MOST OF THE BOOK IS BASED ON REAL RADAR SYSTEMS RATHER THAN THEORETICAL STUDIES THE RESULT IS A VALUABLE EASY TO USE GUIDE THAT MAKES THE DIFFICULT PARTS OF THE FIELD EASIER AND HELPS READERS DO PERFORMANCE CALCULATIONS QUICKLY AND EASILY

THE RAPID DEVELOPMENT OF ELECTRONICS AND ITS ENGINEERING APPLICATIONS ENSURES THAT NEW TOPICS ARE ALWAYS COMPETING FOR A PLACE IN UNIVERSITY AND POLYTECHNIC COURSES BUT IT IS OFTEN DIFFICULT FOR LECTURERS TO FIND SUITABLE BOOKS FOR RECOMMENDATION TO STUDENTS PARTICULARLY WHEN A TOPIC IS COVERED BY A SHORT LECTURE MODULE OR AS AN OPTION MACMILLAN NEW ELECTRONICS OFFERS INTRODUCTIONS TO ADVANCED TOPICS THE LEVEL IS GENERALLY THAT OF SECOND AND SUBSEQUENT YEARS OF UNDERGRADUATE COURSES IN ELECTRONIC AND ELECTRICAL ENGINEERING COMPUTER SCIENCE AND PHYSICS SOME OF THE AUTHORS WILL PAINT WITH A BROAD BRUSH OTHERS WILL CONCENTRATE ON A NARROWER TOPIC AND COVER IT IN GREATER DETAIL BUT IN ALL CASES THE TITLES IN THE SERIES WILL PROVIDE A SOUND BASIS FOR FURTHER READING OF THE SPECIALIST LITERATURE AND AN UP TO DATE APPRECIATION OF PRACTICAL APPLICATIONS AND LIKELY TRENDS THE LEVEL SCOPE AND APPROACH OF THE SERIES SHOULD ALSO APPEAL TO PRACTISING ENGINEERS AND SCIENTISTS ENCOUNTERING AN AREA OF ELECTRONICS FOR THE FIRST TIME OR NEEDING A RAPID AND AUTHORITATIVE UPDATE VII PREFACE THE BASIC PRINCIPLES OF RADAR DO NOT CHANGE BUT THE DESIGN AND TECHNOLOGY OF PRACTICAL RADAR SYSTEMS HAVE DEVELOPED RAPIDLY IN RECENT YEARS ADVANCES IN DIGITAL ELECTRONICS AND COMPUTING ARE HAVING A MAJOR IMPACT ESPECIALLY IN RADAR SIGNAL PROCESSING AND DISPLAY I HOPE THAT THIS BOOK WILL PROVE A USEFUL INTRODUCTION TO SUCH DEVELOPMENTS AS WELL AS TO THE UNDERLYING PRINCIPLES OF RADAR DETECTION

AN INTRODUCTION TO RADAR SYSTEMS SHOULD IDEALLY BE SELF CONTAINED AND HANDS ON A COMBINATION LACKING IN MOST RADAR TEXTS THE FIRST EDITION OF RADAR SYSTEMS ANALYSIS AND DESIGN USING MATLAB PROVIDED SUCH AN APPROACH AND THE SECOND EDITION CONTINUES IN THE SAME VEIN THIS EDITION HAS BEEN UPDATED EXPANDED AND REORGANIZED TO INCLUDE ADVANCES IN T

A THOROUGH UPDATE TO THE ARTECH HOUSE CLASSIC MODERN RADAR SYSTEMS ANALYSIS THIS REFERENCE IS A COMPREHENSIVE AND COHESIVE INTRODUCTION TO

RADAR SYSTEMS DESIGN AND PERFORMANCE ESTIMATION IT OFFERS YOU THE KNOWLEDGE YOU NEED TO SPECIFY EVALUATE OR APPLY RADAR TECHNOLOGY IN CIVILIAN OR MILITARY SYSTEMS THE BOOK PRESENTS ACCURATE DETECTION RANGE EQUATIONS THAT LET YOU REALISTICALLY ESTIMATE RADAR PERFORMANCE IN A VARIETY OF PRACTICAL SITUATIONS WITH ITS CLEAR EASY TO UNDERSTAND LANGUAGE YOU QUICKLY LEARN THE TRADEOFFS BETWEEN CHOICE OF WAVELENGTH AND RADAR PERFORMANCE AND SEE THE INHERENT ADVANTAGES AND LIMITATIONS ASSOCIATED WITH EACH RADAR BAND YOU FIND MODELING PROCEDURES TO HELP YOU ANALYZE ENEMY SYSTEMS OR EVALUATE RADAR INTEGRATED INTO NEW WEAPON SYSTEMS THE BOOK COVERS ECM AND ECCM FOR BOTH SURVEILLANCE AND TRACKING TO HELP YOU ESTIMATE THE EFFECTS OF ACTIVE AND PASSIVE ECM SELECT HARDWARE SOFTWARE FOR RECONNAISSANCE OR JAMMING AND PLAN THE OPERATION OF EW SYSTEMS AS RADAR SYSTEMS EVOLVE THIS BOOK PROVIDES THE EQUATIONS NEEDED TO CALCULATE AND EVALUATE THE PERFORMANCE OF THE LATEST ADVANCES IN RADAR TECHNOLOGY

THIS IS A COMPREHENSIVE BOOK ABOUT MODERN RADAR TECHNIQUES DESCRIBING SYSTEMS AND METHODS AT THE COLLEGE AND GRADUATE STUDENT LEVEL IT COVERS RADAR PRINCIPLES RADAR TECHNOLOGY AND THE APPLICATION OF THAT TECHNOLOGY THIS BOOK STARTS WITH RADAR CROSS SECTION RCS SIMULATION AND RADAR FREQUENCY SYNTHESISERS DESCRIBES A MANIPULATION OF RCS WITH PLASMA AND DEVELOPS A MILLIMETRE WAVE FREQUENCY SYNTHESISER FOR RADAR SYSTEMS NEXT MULTI PULSE PERFORMANCE EVALUATION OF ADAPTIVE DETECTION OF FLUCTUATION RADAR TARGETS AND A C BAND RADAR OVER AN URBAN AREA ARE INTRODUCED FOLLOWED BY THE INTERPOLATION OF THE RADIAL VELOCITY DATA FROM COASTAL HF RADARS AT THE FINISH THREE DIMENSIONAL SYNTHETIC APERTURE RADAR SAR MECHANISMS AND IMAGING IS INTRODUCED FOLLOWED BY GPU BASED SAR RAW DATA SIMULATION FOR A COMPLEX THREE DIMENSIONAL SCENE THIS BOOK WILL BE OF PRACTICAL USE TO ENGINEERS TECHNICIANS PLANNERS SPECIFIERS AND MANAGERS WHO WORK WITH RADAR SYSTEMS AND WITH SYSTEMS CONTAINING RADARS AND RADAR TECHNOLOGY

INTRODUCTION TO RADAR ANALYSIS SECOND EDITION IS A MAJOR REVISION OF THE POPULAR TEXTBOOK IT IS WRITTEN WITHIN THE CONTEXT OF COMMUNICATION THEORY AS WELL AS THE THEORY OF SIGNALS AND NOISE BY EMPHASIZING PRINCIPLES AND FUNDAMENTALS THE TEXTBOOK SERVES AS A VITAL SOURCE FOR STUDENTS AND ENGINEERS PART I BRIDGES THE GAP BETWEEN COMMUNICATION SIGNAL ANALYSIS AND RADAR TOPICS INCLUDE MODULATION TECHNIQUES AND ASSOCIATED CONTINUOUS WAVE CW AND PULSED RADAR SYSTEMS PART II IS DEVOTED TO RADAR SIGNAL PROCESSING AND PULSE COMPRESSION TECHNIQUES PART III PRESENTS SPECIAL TOPICS IN RADAR SYSTEMS INCLUDING RADAR DETECTION RADAR CLUTTER TARGET TRACKING PHASED ARRAYS AND SYNTHETIC APERTURE RADAR SAR MANY NEW EXERCISE ARE INCLUDED AND THE AUTHOR PROVIDES COMPREHENSIVE EASY TO FOLLOW MATHEMATICAL DERIVATIONS OF ALL KEY EQUATIONS AND FORMULAS THE AUTHOR HAS WORKED EXTENSIVELY FOR THE U S ARMY THE U S SPACE AND MISSILE COMMAND AND OTHER MILITARY AGENCIES THIS IS NOT JUST A TEXTBOOK FOR SENIOR LEVEL AND GRADUATES STUDENTS BUT A VALUABLE TOOL FOR PRACTICING RADAR ENGINEERS FEATURES AUTHORED BY A LEADING INDUSTRY RADAR PROFESSIONAL COMPREHENSIVE UP TO DATE COVERAGE OF RADAR SYSTEMS ANALYSIS ISSUES EASY TO FOLLOW MATHEMATICAL DERIVATIONS OF ALL EQUATIONS AND FORMULAS NUMEROUS GRAPHICAL PLOTS AND TABLE FORMAT OUTPUTS ONE PART OF THE BOOK IS DEDICATED TO RADAR WAVEFORMS AND RADAR SIGNAL PROCESSING

AS WELL AS BEING FULLY UP TO DATE THIS BOOK PROVIDES WIDER SUBJECT COVERAGE THAN MANY OTHER RADAR BOOKS THE INCLUSION OF A CHAPTER ON

SKYWAVE RADAR AND FULL CONSIDERATION OF HF OTH ISSUES MAKES THIS BOOK ESPECIALLY RELEVANT FOR COMMUNICATIONS ENGINEERS AND THE DEFENCE SECTOR EXPLAINS KEY THEORY AND MATHEMATICS FROM SQUARE ONE USING CASE STUDIES WHERE RELEVANT DESIGNED SO THAT MATHEMATICAL SECTIONS CAN BE SKIPPED WITH NO LOSS OF CONTINUITY BY THOSE NEEDING ONLY A QUALITATIVE UNDERSTANDING THEORETICAL CONTENT PRESENTED ALONGSIDE APPLICATIONS AND WORKING EXAMPLES MAKE THE BOOK SUITABLE TO STUDENTS OR OTHERS NEW TO THE SUBJECT AS WELL AS A PROFESSIONAL REFERENCE

THIS BOOK PRESENTS THE BASIC PRINCIPLES ANALYSES DESIGN FORMULAS AND CHARACTERISTICS OF VARIOUS FIN LINE CONFIGURATIONS YOU LL FIND SUMMARIES OF HUNDREDS OF RIGOROUS FORMULAS AS WELL AS APPROXIMATE CLOSED FORM EXPRESSIONS WHICH CAN BE READILY PROGRAMMED TO GENERATE DESIGN DATA FOR ANY STRUCTURE DISCOVER MILLIMETER WAVE INTEGRATED CIRCUITS AND COMPONENTS REALIZED USING THE VARIOUS FIN LINE TECHNIQUES PRESENTED IN THE TEXT INCLUDING DIRECTIONAL COUPLERS POWER DIVIDERS ATTENUATORS DETECTORS MODULATORS AND OSCILLATORS AN ARTECH HOUSE BESTSELLER

THE IMPORTANT AND FASCINATING TOPICS OF RADAR ENJOY AN EXTENSIVE AUDIENCE IN INDUSTRY AND GOVERNMENT BUT DESERVE MORE ATTENTION IN UNDERGRADUATE EDUCATION TO BETTER PREPARE GRADUATING ENGINEERS TO MEET THE DEMANDS OF MODERN MANKIND RADAR IS NOT ONLY ONE OF THE MAJOR APPLICATIONS OF ELECTRONICS AND ELECTROMAGNETIC COMMUNICATIONS BUT IT IS ALSO A MATURE SCIENTIFIC DISCIPLINE WITH SIGNIFICANT THEORETICAL AND MATHEMATICAL FOUNDATIONS THAT WARRANT AN INTELLECTUAL AND EDUCATIONAL CHALLENGE FUNDAMENTAL PRINCIPLES OF RADAR IS A TEXTBOOK PROVIDING A FIRST EXPOSURE TO RADAR PRINCIPLES IT PROVIDES A BROAD CONCEPT UNDERLYING THE BASIC PRINCIPLE OF OPERATIONS OF MOST EXISTING RADAR SYSTEMS AND MAINTAINS A GOOD BALANCE OF MATHEMATICAL RIGOR TO CONVINCE READERS WITHOUT LOSING INTEREST THE BOOK PROVIDES AN EXTENSIVE EXPOSITION OF THE TECHNIQUES CURRENTLY BEING USED FOR RADAR SYSTEM DESIGN ANALYSIS AND EVALUATION IT PRESENTS A COMPREHENSIVE SET OF RADAR PRINCIPLES INCLUDING ALL FEATURES OF MODERN RADAR APPLICATIONS WITH THEIR UNDERLYING DERIVATIONS USING SIMPLE MATHEMATICS COVERAGE IS LIMITED TO THE MAIN CONCEPTS OF RADAR IN ORDER TO PRESENT THEM IN A SYSTEMATIC AND ORGANIZED FASHION TOPICS ARE TREATED NOT AS ABSTRUSE AND ESOTERIC TO THE POINT OF INCOMPREHENSIBILITY BUT THE VERY COMPLEX AND RICH TECHNOLOGY OF RADAR IS DISTILLED INTO ITS FUNDAMENTALS THE AUTHOR S EMPHASIS IS ON CLARITY WITHOUT SACRIFICING RIGOR AND COMPLETENESS THUS MAKING THE BOOK BROAD ENOUGH TO SATISFY A VARIETY OF BACKGROUNDS AND INTERESTS THOROUGH DOCUMENTATION PROVIDES AN UNUSUAL DEGREE OF COMPLETENESS FOR A TEXTBOOK AT THIS LEVEL WITH INTERESTING AND SOMETIMES THOUGHT PROVOKING CONTENT TO MAKE THE SUBJECT EVEN MORE APPEALING KEY FEATURES COVERS A WIDE RANGE OF TOPICS IN RADAR SYSTEMS INCLUDES EXAMPLES AND EXERCISES TO REINFORCE THE CONCEPTS PRESENTED AND EXPLAIN THEIR APPLICATIONS PROVIDES SELF CONTAINED CHAPTERS USEFUL FOR READERS SEEKING SELECTIVE TOPICS PROVIDES BROAD CONCEPTS UNDERLYING THE BASIC PRINCIPLES OF OPERATIONS OF MOST TYPES OF RADARS IN USE TODAY INCLUDES DOCUMENTATION TO LEAD TO FURTHER READING OF INTERESTING CONCEPTS AND APPLICATIONS

DISCOVER THE TECHNOLOGY FOR THE NEXT GENERATION OF RADAR SYSTEMS HERE IS THE FIRST BOOK THAT BRINGS TOGETHER THE KEY CONCEPTS ESSENTIAL FOR THE APPLICATION OF KNOWLEDGE BASED SYSTEMS KBS TO RADAR DETECTION TRACKING CLASSIFICATION AND SCHEDULING THE BOOK HIGHLIGHTS THE LATEST ADVANCES IN BOTH KBS AND RADAR SIGNAL AND DATA PROCESSING PRESENTING A RANGE OF PERSPECTIVES AND INNOVATIVE RESULTS THAT HAVE SET THE STAGE FOR THE NEXT GENERATION OF ADAPTIVE RADAR SYSTEMS THE BOOK BEGINS WITH A CHAPTER INTRODUCING THE CONCEPT OF KNOWLEDGE BASED KB RADAR THE

REMAINING NINE CHAPTERS FOCUS ON CURRENT DEVELOPMENTS AND RECENT APPLICATIONS OF KB CONCEPTS TO SPECIFIC RADAR FUNCTIONS AMONG THE KEY TOPICS EXPLORED ARE FUNDAMENTALS OF RELEVANT KB TECHNIQUES KB SOLUTIONS AS THEY APPLY TO THE GENERAL RADAR PROBLEM KBS APPLICATIONS FOR THE CONSTANT FALSE ALARM RATE PROCESSOR KB CONTROL FOR SPACE TIME ADAPTIVE PROCESSING KB TECHNIQUES APPLIED TO EXISTING RADAR SYSTEMS INTEGRATED END TO END RADAR SIGNALS DATA PROCESSING WITH OVERARCHING KB CONTROL ALL CHAPTERS ARE SELF CONTAINED ENABLING READERS TO FOCUS ON THOSE TOPICS OF GREATEST INTEREST EACH ONE BEGINS WITH INTRODUCTORY REMARKS MOVES ON TO DETAILED DISCUSSIONS AND ANALYSIS AND ENDS WITH A LIST OF REFERENCES THROUGHOUT THE PRESENTATION THE AUTHORS OFFER EXAMPLES OF HOW KBS WORKS AND HOW IT CAN DRAMATICALLY IMPROVE RADAR PERFORMANCE AND CAPABILITY MOREOVER THE AUTHORS FORECAST THE IMPACT OF KB TECHNOLOGY ON FUTURE SYSTEMS INCLUDING IMPORTANT CIVILIAN MILITARY AND HOMELAND DEFENSE APPLICATIONS WITH CHAPTERS CONTRIBUTED BY LEADING INTERNATIONAL RESEARCHERS AND PIONEERS IN THE FIELD THIS TEXT IS RECOMMENDED FOR BOTH STUDENTS AND PROFESSIONALS IN RADAR AND SONAR DETECTION TRACKING AND CLASSIFICATION AND RADAR RESOURCE MANAGEMENT

SINCE THE PUBLICATION OF THE SECOND EDITION OF INTRODUCTION TO RADAR SYSTEMS THERE HAS BEEN CONTINUAL DEVELOPMENT OF NEW RADAR CAPABILITIES AND CONTINUAL IMPROVEMENTS TO THE TECHNOLOGY AND PRACTICE OF RADAR THIS GROWTH HAS NECESSITATED THE ADDITION AND UPDATING OF THE FOLLOWING TOPICS FOR THE THIRD EDITION DIGITAL TECHNOLOGY AUTOMATIC DETECTION AND TRACKING DOPPLER TECHNOLOGY AIRBORNE RADAR AND TARGET RECOGNITION THE TOPIC COVERAGE IS ONE OF THE GREAT STRENGTHS OF THE TEXT IN ADDITION TO A THOROUGH REVISION OF TOPICS AND DELETION OF OBSOLETE MATERIAL THE AUTHOR HAS ADDED END OF CHAPTER PROBLEMS TO ENHANCE THE TEACHABILITY OF THIS CLASSIC BOOK IN THE CLASSROOM AS WELL AS FOR SELF STUDY FOR PRACTICING ENGINEERS

THIS BESTSELLING BOOK NOW IN ITS SECOND EDITION INTRODUCES THE BASIC PRINCIPLES OF PASSIVE RADAR TECHNOLOGY AND PROVIDES A COMPREHENSIVE OVERVIEW OF THE RECENT DEVELOPMENTS AND ADVANCES IN THIS FIELD IT SHOWS YOU HOW PASSIVE RADAR WORKS HOW IT DIFFERS FROM THE ACTIVE TYPE AND HELPS YOU UNDERSTAND THE BENEFITS AND DRAWBACKS OF THIS NOVEL TECHNOLOGY THE BOOK GIVES YOU THE KNOWLEDGE YOU NEED TO GET A FULL UNDERSTANDING OF THIS FASCINATING TECHNOLOGY ALL CHAPTERS HAVE BEEN FULLY REVISED AND UPDATED AND ARE WRITTEN IN A CLEAR AND ACCESSIBLE STYLE NEW CHAPTERS HAVE BEEN ADDED TO COVER ADVANCES IN THE TECHNOLOGY THAT HAVE ALREADY BEEN BUILT AND DEMONSTRATED INCLUDING SYSTEMS ON MOVING PLATFORMS AIRCRAFT AND UAVS AS WELL AS ADVANCES IN TYPES OF TRANSMISSION NOTABLY SINGLE FREQUENCY BROADCAST TRANSMISSIONS AND 5G AND IN PROCESSING TECHNIQUES THIS BOOK REMAINS AN IMPORTANT RESOURCE FOR ENGINEERS WORKING IN ACADEMIC INDUSTRY OR GOVERNMENT RESEARCH LABORATORIES ACADEMICS TEACHING GRADUATE LEVEL STUDENTS AND THOSE WORKING IN THE SPECIFICATION AND PROCUREMENT OF RADAR SYSTEMS WHO NEED TO UNDERSTAND THE PERFORMANCE AND LIMITATIONS OF THE TECHNOLOGY

THIS COMPREHENSIVE REFERENCE EXPLAINS THE MANY PROCESSES NEEDED FOR CREATING RADAR SYSTEMS AND NAVIGATION AIDS SELECTED TOPICS INCLUDE ANTENNAS RADAR TARGETS DOPPLER RADAR ATMOSPHERIC PROBING MATHEMATICAL PRELIMINARIES HYPERBOLIC NAVIGATION AIRCRAFT HOMING SYSTEMS NAVIGATION MEASURING TECHNIQUES SATELLITE NAVIGATION AMONG OTHERS

THIS IS AN ORIGINAL AND COMPREHENSIVE MONOGRAPH ON THE INCREASINGLY IMPORTANT FIELD OF MULTISTATIC RADAR SYSTEMS THE MATERIAL COVERED INCLUDES TARGET DETECTION COORDINATE AND TRAJECTORY PARAMETER ESTIMATION OPTIMUM AND SUBOPTIMUM DETECTORS AND EXTERNAL INTERFERENCES THE PRACTICAL PROBLEMS FACED BY THOSE WORKING WITH RADAR SYSTEMS ARE CONSIDERED MOST ALGORITHMS ARE PRESENTED IN A FORM ALLOWING DIRECT USE IN ENGINEERING PRACTICE AND MANY OF THE RESULTS CAN BE IMMEDIATELY APPLIED TO INFORMATION SYSTEMS CONTAINING DIFFERENT TYPES OF SENSORS NOT ONLY RADARS THIS BOOK IS THE REVISED INTERNATIONAL EDITION OF CHERNYAK'S RENOWNED RUSSIAN TEXTBOOK

A PRACTICAL TOOL ON RADAR SYSTEMS THAT WILL BE OF MAJOR HELP TO TECHNICIANS STUDENT ENGINEERS AND ENGINEERS WORKING IN INDUSTRY AND IN RADAR RESEARCH AND DEVELOPMENT THE MANY USERS OF RADAR AS WELL AS SYSTEMS ENGINEERS AND DESIGNERS WILL ALSO FIND IT HIGHLY USEFUL ALSO OF INTEREST TO PILOTS AND FLIGHT ENGINEERS AND MILITARY COMMAND PERSONNEL AND MILITARY CONTRACTORS THIS INTRODUCTION TO THE FIELD OF RADAR IS INTENDED FOR ACTUAL USERS OF RADAR IT FOCUSES ON THE HISTORY MAIN PRINCIPLES FUNCTIONS MODES PROPERTIES AND SPECIFIC NATURE OF MODERN AIRBORNE RADAR THE BOOK EXAMINES RADAR'S ROLE WITHIN THE SYSTEM WHEN CARRYING OUT ITS ASSIGNED MISSIONS SHOWING THE POSSIBILITIES OF RADAR AS WELL AS ITS LIMITATIONS FINALLY GIVEN THE CHANGING OPERATIONAL REQUIREMENTS AND THE POTENTIAL OPENED UP BY MODERN TECHNOLOGICAL DEVELOPMENTS A CONCLUDING SECTION DESCRIBES HOW RADAR MAY EVOLVE IN THE FUTURE THE AUTHORS REVIEW THE CURRENT STATE OF THE MAIN TYPES OF AIRBORNE AND SPACEBORNE RADAR SYSTEMS DESIGNED FOR SPECIFIC MISSIONS AS WELL AS FOR THE GLOBAL ENVIRONMENT OF THEIR HOST AIRCRAFT OR SATELLITES THEY INCLUDE NUMEROUS EXAMPLES OF THE PARAMETERS OF THESE RADARS THE EMPHASIS IN THE BOOK IS NOT ONLY ON A PARTICULAR RADAR TECHNIQUE BUT EQUALLY ON THE MAIN RADAR FUNCTIONS AND MISSIONS EVEN IF A WIDE RANGE OF TECHNIQUES ARE DESCRIBED IN THIS BOOK THE FOCUS IS ON THOSE WHICH ARE CONNECTED TO PRACTICAL APPLICATIONS

IN PLANNING A RADAR SYSTEM HAVING THE PROPER MATHEMATICAL MODELING OF PROPAGATION EFFECTS CLUTTER AND TARGET STATISTICS IS ESSENTIAL RADAR SYSTEMS PRINCIPLES PROVIDES A STRONG THEORETICAL BASIS FOR THE MYRIAD OF FORMULAS AND RULES OF THUMB REQUIRED FOR ANALYSIS CONCEPTUAL DESIGN AND PERFORMANCE EVALUATION OF RADAR SYSTEMS MATHEMATICAL DERIVATIONS OF FORMULAS COMMONLY USED BY RADAR ENGINEERS ARE PRESENTED WITH DETAILED DISCUSSIONS OF THE ASSUMPTIONS BEHIND THESE EXPRESSIONS AND THEIR RANGES OF VALIDITY THESE PRINCIPLES ARE USED IN A WIDE RANGE OF RADAR APPLICATIONS RADAR SYSTEMS PRINCIPLES MAKES IT EASY TO UNDERSTAND THE STEPS IN CALCULATING VARIOUS FORMULAS AND WHEN AND HOW THESE FORMULAS ARE USED A SET OF PROBLEMS IS PROVIDED FOR EACH CHAPTER ENABLING YOU TO CHECK YOUR PROGRESS IN APPLYING THE PRINCIPLES DISCUSSED IN EACH SECTION OF THE TEXT THERE ARE MORE THAN 170 FIGURES ILLUSTRATING KEY CONCEPTS NUMEROUS REFERENCES TO WELL KNOWN BOOKS ON RADAR FOR COVERAGE OF PRACTICAL DESIGN ISSUES AND OTHER SPECIALIZED TOPICS ARE GIVEN RADAR SYSTEMS PRINCIPLES IS AN IDEAL TEXTBOOK FOR ADVANCED UNDERGRADUATES AND FIRST YEAR GRADUATE STUDENTS AND ALSO MAKES AN EXCELLENT VEHICLE FOR SELF STUDY BY ENGINEERS WISHING TO ENHANCE THEIR UNDERSTANDING OF RADAR PRINCIPLES AND THEIR IMPLICATION IN ACTUAL SYSTEMS

MODERN RADAR DETECTION IS THE NEW FRONTIER FOR ADVANCED RADAR SYSTEMS CAPABLE OF OPERATING IN CHALLENGING SCENARIOS WITH A PLURALITY OF INTERFERENCE SOURCES BOTH MANMADE AND NATURAL WRITTEN BY TOP RESEARCHERS AND RECOGNIZED LEADERS IN THE FIELD THIS IS THE FIRST BOOK TO PROVIDE

A COMPREHENSIVE UNDERSTANDING OF THE CURRENT RESEARCH TRENDS IN MODERN RADAR DETECTION IT UPDATES READERS WITH THE LATEST RADAR SIGNAL PROCESSING ALGORITHMS NOW CAPABLE WITH HIGH SPEED COMPUTER CHIPS AND SOPHISTICATED PROGRAMS IT ALSO INCLUDES EXAMPLES AND APPLICATIONS FROM REAL SYSTEMS THIS IS ESSENTIAL READING FOR RADAR SYSTEMS DESIGN ENGINEERS WITHIN AEROSPACE COMPANIES MILITARY RADAR ENGINEERS AND AEROSPACE CONTRACTORS CONSULTANTS

THANK YOU VERY MUCH FOR DOWNLOADING **INTRODUCTION TO RADAR SYSTEMS 3RD EDITION**. AS YOU MAY KNOW, PEOPLE HAVE LOOK HUNDREDS TIMES FOR THEIR FAVORITE READINGS LIKE THIS INTRODUCTION TO RADAR SYSTEMS 3RD EDITION, BUT END UP IN MALICIOUS DOWNLOADS. RATHER THAN ENJOYING A GOOD BOOK WITH A CUP OF TEA IN THE AFTERNOON, INSTEAD THEY COPE WITH SOME HARMFUL BUGS INSIDE THEIR DESKTOP COMPUTER. INTRODUCTION TO RADAR SYSTEMS 3RD EDITION IS AVAILABLE IN OUR BOOK COLLECTION AN ONLINE ACCESS TO IT IS SET AS PUBLIC SO YOU CAN DOWNLOAD IT INSTANTLY. OUR BOOKS COLLECTION SAVES IN MULTIPLE COUNTRIES, ALLOWING YOU TO GET THE MOST LESS LATENCY TIME TO DOWNLOAD ANY OF OUR BOOKS LIKE THIS ONE. MERELY SAID, THE INTRODUCTION TO RADAR SYSTEMS 3RD EDITION IS UNIVERSALLY COMPATIBLE WITH ANY DEVICES TO READ.

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8. SEVERAL OF INTRODUCTION TO RADAR SYSTEMS 3RD EDITION ARE FOR SALE TO FREE WHILE SOME ARE PAYABLE. IF YOU ARENT SURE IF THE BOOKS YOU WOULD LIKE TO DOWNLOAD WORKS WITH FOR USAGE ALONG WITH YOUR COMPUTER, IT IS POSSIBLE TO DOWNLOAD FREE TRIALS. THE FREE GUIDES MAKE IT EASY FOR SOMEONE TO FREE ACCESS ONLINE LIBRARY FOR DOWNLOAD BOOKS TO YOUR DEVICE. YOU CAN GET FREE DOWNLOAD ON FREE TRIAL FOR LOTS OF BOOKS CATEGORIES.

9. OUR LIBRARY IS THE BIGGEST OF THESE THAT HAVE LITERALLY HUNDREDS OF THOUSANDS OF DIFFERENT PRODUCTS CATEGORIES REPRESENTED. YOU WILL ALSO SEE THAT THERE ARE SPECIFIC SITES CATERED TO DIFFERENT PRODUCT TYPES OR CATEGORIES, BRANDS OR NICHEs RELATED WITH INTRODUCTION TO RADAR SYSTEMS 3RD EDITION. SO DEPENDING ON WHAT EXACTLY YOU ARE SEARCHING, YOU WILL BE ABLE TO CHOOSE E BOOKS TO SUIT YOUR OWN NEED.
10. NEED TO ACCESS COMPLETELY FOR CAMPBELL BIOLOGY SEVENTH EDITION BOOK? ACCESS EBOOK WITHOUT ANY DIGGING. AND BY HAVING ACCESS TO OUR EBOOK ONLINE OR BY STORING IT ON YOUR COMPUTER, YOU HAVE CONVENIENT ANSWERS WITH INTRODUCTION TO RADAR SYSTEMS 3RD EDITION TO GET STARTED FINDING INTRODUCTION TO RADAR SYSTEMS 3RD EDITION, YOU ARE RIGHT TO FIND OUR WEBSITE WHICH HAS A COMPREHENSIVE COLLECTION OF BOOKS ONLINE. OUR LIBRARY IS THE BIGGEST OF THESE THAT HAVE LITERALLY HUNDREDS OF THOUSANDS OF DIFFERENT PRODUCTS REPRESENTED. YOU WILL ALSO SEE THAT THERE ARE SPECIFIC SITES CATERED TO DIFFERENT CATEGORIES OR NICHEs RELATED WITH INTRODUCTION TO RADAR SYSTEMS 3RD EDITION SO DEPENDING ON WHAT EXACTLY YOU ARE SEARCHING, YOU WILL BE ABLE TO CHOOSE EBOOK TO SUIT YOUR OWN NEED.
11. THANK YOU FOR READING INTRODUCTION TO RADAR SYSTEMS 3RD EDITION. MAYBE YOU HAVE KNOWLEDGE THAT, PEOPLE HAVE SEARCH NUMEROUS TIMES FOR THEIR FAVORITE READINGS LIKE THIS INTRODUCTION TO RADAR SYSTEMS 3RD EDITION, BUT END UP IN HARMFUL DOWNLOADS.
12. RATHER THAN READING A GOOD BOOK WITH A CUP OF COFFEE IN THE AFTERNOON, INSTEAD THEY JUGGLED

WITH SOME HARMFUL BUGS INSIDE THEIR LAPTOP.

13. INTRODUCTION TO RADAR SYSTEMS 3RD EDITION IS AVAILABLE IN OUR BOOK COLLECTION AN ONLINE ACCESS TO IT IS SET AS PUBLIC SO YOU CAN DOWNLOAD IT INSTANTLY. OUR DIGITAL LIBRARY SPANS IN MULTIPLE LOCATIONS, ALLOWING YOU TO GET THE MOST LESS LATENCY TIME TO DOWNLOAD ANY OF OUR BOOKS LIKE THIS ONE. MERELY SAID, INTRODUCTION TO RADAR SYSTEMS 3RD EDITION IS UNIVERSALLY COMPATIBLE WITH ANY DEVICES TO READ.

## INTRODUCTION

THE DIGITAL AGE HAS REVOLUTIONIZED THE WAY WE READ, MAKING BOOKS MORE ACCESSIBLE THAN EVER. WITH THE RISE OF EBOOKS, READERS CAN NOW CARRY ENTIRE LIBRARIES IN THEIR POCKETS. AMONG THE VARIOUS SOURCES FOR EBOOKS, FREE EBOOK SITES HAVE EMERGED AS A POPULAR CHOICE. THESE SITES OFFER A TREASURE TROVE OF KNOWLEDGE AND ENTERTAINMENT WITHOUT THE COST. BUT WHAT MAKES THESE SITES SO VALUABLE, AND WHERE CAN YOU FIND THE BEST ONES? LET'S DIVE INTO THE WORLD OF FREE EBOOK SITES.

## BENEFITS OF FREE EBOOK SITES

WHEN IT COMES TO READING, FREE EBOOK SITES OFFER NUMEROUS ADVANTAGES.

## COST SAVINGS

FIRST AND FOREMOST, THEY SAVE YOU MONEY. BUYING BOOKS CAN BE EXPENSIVE, ESPECIALLY IF YOU'RE AN AVID READER. FREE EBOOK SITES ALLOW YOU TO ACCESS A VAST ARRAY OF BOOKS WITHOUT SPENDING A DIME.

## ACCESSIBILITY

THESE SITES ALSO ENHANCE ACCESSIBILITY. WHETHER YOU'RE AT HOME, ON THE GO, OR HALFWAY AROUND THE WORLD, YOU CAN ACCESS YOUR FAVORITE TITLES ANYTIME, ANYWHERE, PROVIDED YOU HAVE AN INTERNET CONNECTION.

## VARIETY OF CHOICES

MOREOVER, THE VARIETY OF CHOICES AVAILABLE IS ASTOUNDING. FROM CLASSIC LITERATURE TO CONTEMPORARY NOVELS, ACADEMIC TEXTS TO CHILDREN'S BOOKS, FREE EBOOK SITES COVER ALL GENRES AND INTERESTS.

## TOP FREE EBOOK SITES

THERE ARE COUNTLESS FREE EBOOK SITES, BUT A FEW STAND OUT FOR THEIR QUALITY AND RANGE OF OFFERINGS.



## PROJECT GUTENBERG

PROJECT GUTENBERG IS A PIONEER IN OFFERING FREE EBOOKS. WITH OVER 60,000 TITLES, THIS SITE PROVIDES A WEALTH OF CLASSIC LITERATURE IN THE PUBLIC DOMAIN.

## OPEN LIBRARY

OPEN LIBRARY AIMS TO HAVE A WEBPAGE FOR EVERY BOOK EVER PUBLISHED. IT OFFERS MILLIONS OF FREE EBOOKS, MAKING IT A FANTASTIC RESOURCE FOR READERS.

## GOOGLE BOOKS

GOOGLE BOOKS ALLOWS USERS TO SEARCH AND PREVIEW MILLIONS OF BOOKS FROM LIBRARIES AND PUBLISHERS WORLDWIDE. WHILE NOT ALL BOOKS ARE AVAILABLE FOR FREE, MANY ARE.

## MANYBOOKS

MANYBOOKS OFFERS A LARGE SELECTION OF FREE EBOOKS IN VARIOUS GENRES. THE SITE IS USER-FRIENDLY AND OFFERS BOOKS IN MULTIPLE FORMATS.

## BOOKBOON

BOOKBOON SPECIALIZES IN FREE TEXTBOOKS AND BUSINESS BOOKS, MAKING IT AN EXCELLENT RESOURCE FOR STUDENTS AND PROFESSIONALS.

## HOW TO DOWNLOAD EBOOKS SAFELY

DOWNLOADING EBOOKS SAFELY IS CRUCIAL TO AVOID PIRATED CONTENT AND PROTECT YOUR DEVICES.

## AVOIDING PIRATED CONTENT

STICK TO REPUTABLE SITES TO ENSURE YOU'RE NOT DOWNLOADING PIRATED CONTENT. PIRATED EBOOKS NOT ONLY HARM AUTHORS AND PUBLISHERS BUT CAN ALSO POSE SECURITY RISKS.

## ENSURING DEVICE SAFETY

ALWAYS USE ANTIVIRUS SOFTWARE AND KEEP YOUR DEVICES UPDATED TO PROTECT AGAINST MALWARE THAT CAN BE HIDDEN IN DOWNLOADED FILES.

## LEGAL CONSIDERATIONS

BE AWARE OF THE LEGAL CONSIDERATIONS WHEN DOWNLOADING EBOOKS. ENSURE THE SITE HAS THE

RIGHT TO DISTRIBUTE THE BOOK AND THAT YOU'RE NOT VIOLATING COPYRIGHT LAWS.

## USING FREE EBOOK SITES FOR EDUCATION

FREE EBOOK SITES ARE INVALUABLE FOR EDUCATIONAL PURPOSES.

## ACADEMIC RESOURCES

SITES LIKE PROJECT GUTENBERG AND OPEN LIBRARY OFFER NUMEROUS ACADEMIC RESOURCES, INCLUDING TEXTBOOKS AND SCHOLARLY ARTICLES.

## LEARNING NEW SKILLS

YOU CAN ALSO FIND BOOKS ON VARIOUS SKILLS, FROM COOKING TO PROGRAMMING, MAKING THESE SITES GREAT FOR PERSONAL DEVELOPMENT.

## SUPPORTING HOMESCHOOLING

FOR HOMESCHOOLING PARENTS, FREE EBOOK SITES PROVIDE A WEALTH OF EDUCATIONAL MATERIALS FOR DIFFERENT GRADE LEVELS AND SUBJECTS.

## GENRES AVAILABLE ON FREE EBOOK SITES

THE DIVERSITY OF GENRES AVAILABLE ON FREE EBOOK SITES ENSURES THERE'S SOMETHING FOR

EVERYONE.

## FICTION

FROM TIMELESS CLASSICS TO CONTEMPORARY BESTSELLERS, THE FICTION SECTION IS BRIMMING WITH OPTIONS.

## Non-FICTION

Non-fiction enthusiasts can find biographies, self-help books, historical texts, and more.

## TEXTBOOKS

STUDENTS CAN ACCESS TEXTBOOKS ON A WIDE RANGE OF SUBJECTS, HELPING REDUCE THE FINANCIAL BURDEN OF EDUCATION.

## CHILDREN'S BOOKS

PARENTS AND TEACHERS CAN FIND A PLETHORA OF CHILDREN'S BOOKS, FROM PICTURE BOOKS TO YOUNG ADULT NOVELS.

## ACCESSIBILITY FEATURES OF EBOOK SITES

EBOOK SITES OFTEN COME WITH FEATURES THAT ENHANCE ACCESSIBILITY.

## AUDIOBOOK OPTIONS

MANY SITES OFFER AUDIOBOOKS, WHICH ARE GREAT FOR THOSE WHO PREFER LISTENING TO READING.

## ADJUSTABLE FONT SIZES

YOU CAN ADJUST THE FONT SIZE TO SUIT YOUR READING COMFORT, MAKING IT EASIER FOR THOSE WITH VISUAL IMPAIRMENTS.

## TEXT-TO-SPEECH CAPABILITIES

TEXT-TO-SPEECH FEATURES CAN CONVERT WRITTEN TEXT INTO AUDIO, PROVIDING AN ALTERNATIVE WAY TO ENJOY BOOKS.

## TIPS FOR MAXIMIZING YOUR EBOOK EXPERIENCE

TO MAKE THE MOST OUT OF YOUR EBOOK READING EXPERIENCE, CONSIDER THESE TIPS.

## CHOOSING THE RIGHT DEVICE

WHETHER IT'S A TABLET, AN E-READER, OR A SMARTPHONE, CHOOSE A DEVICE THAT OFFERS A COMFORTABLE READING EXPERIENCE FOR YOU.

## ORGANIZING YOUR EBOOK LIBRARY

USE TOOLS AND APPS TO ORGANIZE YOUR EBOOK COLLECTION, MAKING IT EASY TO FIND AND ACCESS YOUR FAVORITE TITLES.

## SYNCING ACROSS DEVICES

MANY EBOOK PLATFORMS ALLOW YOU TO SYNC YOUR LIBRARY ACROSS MULTIPLE DEVICES, SO YOU CAN PICK UP RIGHT WHERE YOU LEFT OFF, NO MATTER WHICH DEVICE YOU'RE USING.

## CHALLENGES AND LIMITATIONS

DESPITE THE BENEFITS, FREE EBOOK SITES COME WITH CHALLENGES AND LIMITATIONS.

## QUALITY AND AVAILABILITY OF TITLES

NOT ALL BOOKS ARE AVAILABLE FOR FREE, AND SOMETIMES THE QUALITY OF THE DIGITAL COPY CAN BE POOR.

## DIGITAL RIGHTS MANAGEMENT (DRM)

DRM CAN RESTRICT HOW YOU USE THE EBOOKS YOU DOWNLOAD, LIMITING SHARING AND TRANSFERRING BETWEEN DEVICES.

## INTERNET DEPENDENCY

ACCESSING AND DOWNLOADING EBOOKS REQUIRES AN INTERNET CONNECTION, WHICH CAN BE A LIMITATION IN AREAS WITH POOR CONNECTIVITY.

## FUTURE OF FREE EBOOK SITES

THE FUTURE LOOKS PROMISING FOR FREE EBOOK SITES AS TECHNOLOGY CONTINUES TO ADVANCE.

## TECHNOLOGICAL ADVANCES

IMPROVEMENTS IN TECHNOLOGY WILL LIKELY MAKE ACCESSING AND READING EBOOKS EVEN MORE SEAMLESS AND ENJOYABLE.

## EXPANDING ACCESS

EFFORTS TO EXPAND INTERNET ACCESS GLOBALLY WILL HELP MORE PEOPLE BENEFIT FROM FREE EBOOK

SITES.

## ROLE IN EDUCATION

AS EDUCATIONAL RESOURCES BECOME MORE DIGITIZED, FREE EBOOK SITES WILL PLAY AN INCREASINGLY VITAL ROLE IN LEARNING.

## CONCLUSION

IN SUMMARY, FREE EBOOK SITES OFFER AN INCREDIBLE OPPORTUNITY TO ACCESS A WIDE RANGE OF BOOKS WITHOUT THE FINANCIAL BURDEN. THEY ARE INVALUABLE RESOURCES FOR READERS OF ALL AGES AND INTERESTS, PROVIDING EDUCATIONAL MATERIALS, ENTERTAINMENT, AND ACCESSIBILITY FEATURES. SO WHY NOT EXPLORE THESE SITES AND DISCOVER THE WEALTH OF KNOWLEDGE THEY OFFER?

## FAQs

ARE FREE EBOOK SITES LEGAL? YES, MOST FREE EBOOK SITES ARE LEGAL. THEY TYPICALLY OFFER BOOKS THAT ARE IN THE PUBLIC DOMAIN OR HAVE THE RIGHTS TO DISTRIBUTE THEM. HOW DO I KNOW IF AN EBOOK SITE IS SAFE? STICK TO WELL-KNOWN AND REPUTABLE SITES LIKE PROJECT GUTENBERG, OPEN LIBRARY, AND GOOGLE BOOKS. CHECK REVIEWS AND ENSURE THE SITE HAS PROPER SECURITY MEASURES. CAN I DOWNLOAD EBOOKS TO ANY DEVICE? MOST FREE EBOOK SITES OFFER DOWNLOADS IN MULTIPLE FORMATS, MAKING THEM COMPATIBLE WITH VARIOUS DEVICES LIKE E-READERS, TABLETS, AND SMARTPHONES. DO FREE EBOOK SITES OFFER AUDIOBOOKS? MANY FREE EBOOK SITES OFFER AUDIOBOOKS, WHICH ARE PERFECT FOR THOSE WHO PREFER LISTENING TO THEIR BOOKS. HOW CAN I SUPPORT AUTHORS IF I USE FREE EBOOK SITES? YOU CAN SUPPORT AUTHORS BY PURCHASING THEIR BOOKS WHEN POSSIBLE, LEAVING REVIEWS, AND SHARING THEIR WORK WITH OTHERS.

