Eastern Economy Edition

Second Edition

# Satellite Communication

## Concepts and Applications

K.N. Raja Rao

PHI

# Satellite Communication
## Concepts and Applications

**SECOND EDITION**

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**SATELLITE COMMUNICATION: Concepts and Applications, Second Edition**
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**To My Parents**

# CONTENTS

*Preface* *ix*

*Preface to the First Edition* *xi*

*Acknowledgements* *xiii*

*Nomenclature* *xv*

**1. AN OVERVIEW OF SPACE AND SATELLITE** **1–16**

1.1 Introduction *1*
1.2 Some Basic Definitions *1*
1.3 Brief History *5*
1.4 Present Status *11*
1.5 Future Trends *12*
*Summary* *16*
*Review Questions* *16*

**2. ORBIT, LAUNCH AND CONTROL** **17–80**

2.1 Introduction *17*
2.2 Satellites in Orbit *17*
2.3 Interpretation of Kepler's Laws *23*
2.4 Satellite Visibility *37*
2.5 Effect of Solar Eclipse *46*
2.6 Satellite Structure *51*
2.7 Telemetry Tracking and Command (T, T & C) *55*
2.8 Satellite Launch *67*
2.9 Emerging Trends in Mission Control *74*
*Summary* *78*
*Review Questions* *78*
*Problems* *79*

**3. CHOICE OF CARRIER** **81–102**

3.1 Introduction *81*
3.2 Controlling Agencies *81*
3.3 Frequency Coordination *82*
3.4 Earth Station Technology *92*

3.5 Typical Satellite Configuration *100*
*Summary* *102*
*Review Questions* *102*

**4. LINK CONCEPTS** **103–180**

4.1 Introduction *103*
4.2 Satellite Link Attributes *103*
4.3 Satellite Link Analysis *104*
4.4 Concept of Noise Temperature *119*
4.5 Analog Link Design *133*
4.6 Video Processing Considerations *142*
4.7 Digital Link Design *151*
4.8 Calculation of Signal to Noise Ratio *159*
4.9 TV Through Satellite *175*
*Summary* *177*
*Review Questions* *177*
*Problems* *178*

**5. SATELLITE ACCESS** **181–240**

5.1 Introduction *181*
5.2 Types of Multiple Access *181*
5.3 Frequency Domain Multiple Access (FDMA) Concepts *186*
5.4 Time Domain Multiple Access (TDMA) Concepts *204*
5.5 Code Domain Multiple Access (CDMA) Concepts *222*
5.6 Space Domain Multiple Access (SDMA) Concepts *230*
5.7 In-Orbit Tests *233*
*Summary* *238*
*Review Questions* *238*
*Problems* *239*

**6. SATELLITE SUB-SYSTEMS** **241–265**

6.1 Introduction *241*
6.2 Power Supply *241*
6.3 Satellite Antenna *253*
6.4 Earth Station Antenna *255*
*Summary* *264*
*Review Questions* *264*
*Problems* *265*

**7. SATELLITES IN MOBILE COMMUNICATION** **266–319**

7.1 Introduction *266*
7.2 Land Mobile Concepts *266*
7.3 Antenna for Mobile *272*
7.4 Handoff or Handover *273*
7.5 Land Mobile Systems *278*

7.6 Local Broad Band Networks *290*
7.7 Satellites for Mobile Communication *292*
7.8 MSS Frequency Band Allocation *300*
7.9 INMARSAT System *301*
7.10 Other Mobile Satellite Systems *307*
7.11 Low Earth Orbit (LEO) Satellites Systems *308*
7.12 Global Positioning System (GPS) *309*
*Summary* *318*
*Review Questions* *319*

**8. RELIABILITY REQUIREMENTS IN SATELLITES 320–338**

8.1 Introduction *320*
8.2 Reliability *320*
8.3 The Exponential Distribution (A Common Reliability Model) *323*
8.4 Typical Reliability Models in Satellites *325*
8.5 Redundancy *328*
8.6 Fault Tree Analysis *336*
*Summary* *338*
*Review Questions* *338*

**9. REMOTE SENSING SATELLITES 339–348**

9.1 Introduction *339*
9.2 Sensor Technology *342*
9.3 The Process *345*
9.4 Examples of Remote Sensing Satellites *346*
*Summary* *347*
*Review Questions* *348*

**10. ERROR CONTROL CODING 349–371**

10.1 Basic Digital Transmission System *349*
10.2 Block Codes *351*
10.3 Forward Error Correction *356*
10.4 Cyclic Redundancy Check *357*
10.5 Reed Solomon Code *361*
10.6 Convolution Codes *363*
*Summary* *369*
*Review Questions* *370*
*Problems* *370*

***Appendix 1 Important Design Equations*** *373–381*
***Appendix 2 Details of Some of the Satellites*** *382–384*
***Appendix 3 Position Calculations in GPS*** *385–386*

***Bibliography*** *387–388*

***Index*** *389–396*

# PREFACE

This second edition of the book *Fundamentals of Satellite Communication* (now titled as ***Satellite Communication: Concepts and Applications***) continues to provide a smooth flow from satellite launch to link design and then to various applications of satellite.

In the second edition a few new discussions are added in Chapters 1, 2 and 3. Chapter 4 now includes a brief discussion on video and its digitization. This was found necessary as DTH as well as set top boxes today use digitized video transmission. Minor changes have been incorporated in Chapter 5.

In view of usage of satellites in mobile communication, some basic techniques of land mobile and satellite mobile are discussed under Chapter 7. In Chapter 7, a more detailed discussion of GPS has been added.

In additon to this, *Satellite Communication: Concepts and Applications,* Second Edition also includes new chapters on Reliability Requirements in Satellites (Chapter 8), Remote Sensing Satellites (Chapter 9) and Error Control Coding (Chapter 10).

As the satellites have to face harsh environment during launch as well as in orbit, Chapter 8 is devoted to reliability aspects. This chapter covers basics of reliability and also discusses how these are applied to satellites.

Remote sensing is one of the important applications of LEOs, MEOs and GEOs. Therefore, various remote sensing principles have been discussed in Chapter 9.

Chapter 10 is devoted on necessity of error control coding and different error control codes. This chapter also indicates standard codes used in various satellite applications.

The new edition continues to reflect the Indian scenario in satellite communication, which is illustrated in most of the chapters.

I would like to thank personalities and organizations who have supported my efforts. I would be happy to receive constructive suggestions.

**K.N. RAJA RAO**

# PREFACE TO THE FIRST EDITION

One of the important components of a broadband communication system is the satellite link, the other being optical. Satellite communication has become the backbone of long distance communication irrespective of geographical conditions. Satellites have passed the age when their use was restricted to outer space experiments and remote sensing. Today many satellites are multipurpose satellites which are used for communication, meteorological data collection, search and rescue, global positioning systems, mineral and oil exploration etc. Satellite communication has transformed the world into a "global village".

A satellite system represents one of the most sophisticated and intriguing systems to design. Engineers need to consider almost all aspects of applied sciences, engineering and technology. They apply the principles of a variety of scientific disciplines such as physics of materials, sensor technology, virtual instrumentation, communication engineering, automatic control systems, mechanics of structures and so on.

After teaching this subject for nearly a decade I found that there is a need for a structured textbook which would cover the subject comprehensively so as to impart to the reader, full command of the basic concepts and enough of application-oriented knowledge to design satellite links. Though there are a number of books on satellite communications with excellent contents (as referred here in the bibliography) the exact requirement of the students remains to be fully met. The objective of this book is to fulfill their need. The credit therefore goes to my students who prompted me to take up this work. In this book I have tried my best to present the subject in a simple way, yet convey all the important aspects of space and satellite communication. This book is suitable for a one-semester course in space and satellite communication and is written keeping in mind both, undergraduate and postgraduate students. Practising engineers in this field can also refer this book.

This book covers, besides the basic concepts of satellite system; important parameter calculations and design concepts. The emphasis is on geostationary satellites. Beginning with orbiting parameters, the

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