

## **Satellite Communication Systems**

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# **Satellite Communication Systems**

**Design Principles**

**M. Richharia**

BSc(Eng), MSc(Eng), PhD, CEng, MIEE

**Second Edition**





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*To my parents*

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# Preface

Satellite communication systems are now an integral part of most major wide-area telecommunication networks throughout the world. The purpose of this book is to introduce the various elements of a satellite communication system and to develop the principles of system design. The understanding of a complete satellite system requires coverage of a broad range of topics. An attempt has been made to treat each topic at a system level in sufficient depth so as to develop a sound understanding of each element and its relationship to the overall system. Problems and examples have been included to illustrate the applicability of the concepts introduced.

The book consists of 12 chapters. The introductory chapter provides an overview of satellite communications, including a brief history. Chapter 2 discusses the fundamentals of satellite orbits, focusing mainly on the principal features of the geostationary orbit and optimization of non-geostationary satellite constellations. An appendix summarizes various useful orbit-related formulas. Chapter 3 develops a basic understanding of issues involved in selecting frequency for a given satellite communication system. Chapter 4 introduces essential topics such as antenna characteristics, the transmission equation and the effects of noise. The final section of the chapter ties together these concepts, forming the basis of the overall system design. Chapters 5 and 6 discuss, respectively, the topics of modulation and coding applied to satellite communications. The treatment is at a system level so as to assist a system designer in the selection of appropriate modulation and coding schemes for a given application. Chapter 7 characterizes various types of baseband signals commonly used in satellite communications. A satellite is a common resource which must be shared efficiently by a large number of users. Chapter 8 discusses various techniques used for accessing a satellite. Chapters 9 and 10 describe the main sub-systems and outline issues related to the design of communication satellites and earth stations respectively. One of the most innovative recent developments has been the concept of deploying a constellation of low or medium earth satellites to provide personal communication services. Chapter 11 addresses the main issues in the design of non-geostationary satellite systems. The concluding chapter of the book examines the likely future evolution in various areas of satellite communication systems on the basis of current trends and the impact of other developments in telecommunications.

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*Guildford, UK*

Madhavendra (Manu) Richharia

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