

Preface

The satellite network technology is derived from the technology of satellite communication of the 1950s. The initial mode of satellite communication is bent pipe, which sends back to earth what goes into the conduit with only amplification and a shift from uplink to downlink frequency. The satellite network has come true after the emergence of on-board processing and inter-satellite links. The Iridium constellation is a typical example of satellite network. The satellite network developed rapidly since the concept was proposed, and has attracted more and more attention in the recent years. Compared with terrestrial network, satellite network has larger coverage range, easier accessory, and hence is widely used in environmental monitoring, navigation, and resource exploration. Moreover, satellite network can provide wireless access to the Internet for residents in remote areas.

As a core technology of the satellite network system, satellite network routing plays an important role in determining the quality of service of the whole system. Since the environment of the satellite network is quite different from the terrestrial network, the routing of the terrestrial network cannot be used directly in the satellite network. This book analyzes the characteristics of the satellite network, and proposes a series of robust satellite network routing methods including topology design, routing scheme, traffic engineering, and QoS routing algorithms.

The book consists of six chapters. [Chapter 1](#) introduces the basic concept of the satellite network, and the current research status of the satellite network routing. The technical difficulties of satellite network routing are also presented in this chapter. [Chapter 2](#) presents a set of constellation design and optimization schemes. A constellation model that satisfies global coverage, low layer coverage, low system cost, and long continuous coverage time is proposed. The influence of the constellation structure on the network transmission performance is explored through simulations. A novel satellite network virtual grouping routing strategy is proposed in [Chap. 3](#). The dividing method of time slots is improved, the congestion avoidance and node failure handling are added in this chapter, which promotes the robustness of the satellite network routing strategy. A satellite network traffic prediction method based on time series analysis theory according to the terrestrial network traffic information and global user distribution information is proposed in [Chap. 4](#). A traffic engineering method that uses the traffic prediction as the input and maximum link utility as the optimization objective is also

presented in this chapter, which greatly increases the robustness of the satellite network to the unpredicted traffic spike. [Chapter 5](#) proposes a QoS routing algorithm that fits for the environment of satellite network. Heuristic algorithms such as ant colony, genetic algorithm as well as some multiobjective optimization algorithms such as PEC and prior-order algorithm are introduced to optimize for different QoS combination of user requirements, which solves the problem of multi-QoS-objective optimization that cannot be solved by traditional SPF routing algorithm. Finally, the summary and outlook of the research content of this book are made in [Chap. 6](#).

The author has worked for nearly 10 years in research on satellite network routing, and joined the National High Technology Research and Development Program of China (863 Program) and the National Natural Science Foundation of China programs on satellite network routing. This book is a summary of his research experience in constellation design, satellite network routing scheme, and satellite robust QoS routing. We hope that this book will provide useful reference for researchers in the field of satellite network routing, and believe that the publication of this book will promote the theoretical research of the spatial information system.

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