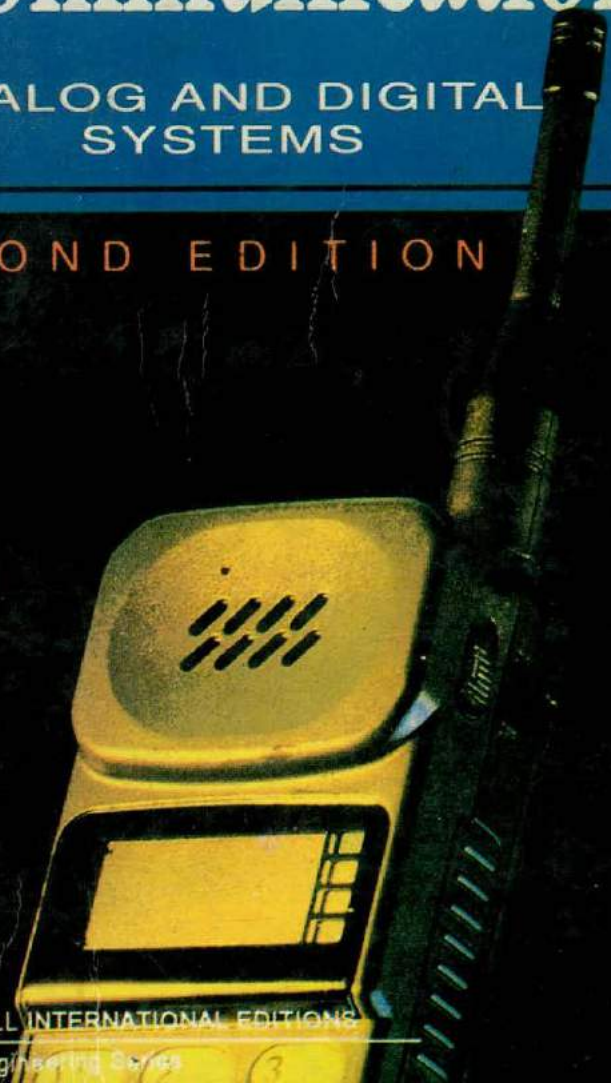


*William C. Y. Lee*

# Mobile Cellular Telecommunications

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Analog and Digital Systems

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# Preface to the Second Edition

Since the book *Mobile Cellular Telecommunications Systems* was last published in 1989, a lot of readers have written to me and given me a great deal of encouragement and compliments. In the last five years, the wireless communications field has been rapidly growing. Many new concepts and new systems have been developed. When Mr. Chapman from McGraw Hill asked me to revise this book, I immediately accepted his offer. Because of the rapid growth in the industry, many engineers are joining in this field from the military industry. Many new engineers who are just graduating from school are also joining this field. They need to learn about this field as quick as possible. Also, the engineers who are already in the field may only work on a small specialized area and want to broaden their knowledge. Therefore, when I revised this book, I wanted to aim it towards their needs. Besides adding many sections in the current chapters, such as calculations of near-field propagation, wireless information superhighway, call blocking and call dropping, etc., I also added three chapters. Chapter 15, Digital Cellular Systems describes newly developed digital systems. The three major ones, GSM, North American TDMA, and CDMA are stated in detail. Others such as DECT, PDC, PHS, MIRS, CD2, CDPD, DCS-1800, PCS, etc., are also included. In Chap. 16, Intelligent Cell Concept and Applications, I have introduced the intelligent means to increase capacity and improve system performance. In Chap. 17, Advanced Intelligent Network (AIN), was introduced. Also, the wideband switch for the future wireless information superhighway was also stated.

In the future, intelligence will be applied to cell sites, networks, and systems. These same thoughts used in cellular will also be applied to PCS.

I hope this book will broaden the readers thoughts. The wireless information superhighway will be our future goal but we still have along way to go.

*William C.Y. Lee*

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# Preface to the First Edition

As the number of cellular subscribers increases, the interference that will be experienced by the systems will also increase. This means that many large cellular systems will, sooner or later, have to handle interference problems. This is a lucrative field that is ripe for research and that will soon be begging for more advanced applications.

This all-inclusive and self-contained work, consisting of fifteen chapters, is a basic textbook that supports further exploration in a new communications field, cellular communications. Since it is the first in its field, this book may be considered a handbook or building block for future research.

For years it has been my desire to write a book on the technical aspects of cellular systems. Since it is a new field, the theory has to be developed and then verified by experiment. I am seeking to adhere to the progression of learning that I described in *Who's Who in America*:

1. Use mathematics to solve problems.
2. Use physics to interpret results.
3. Use experiments and counterexamples to check outcomes.
4. Use pictures to emphasize important points.

Since I have accumulated many pictures in my mind, I would like to share them with my readers. In this field many new applications and theories have been discovered. Thus, my findings will help the reader to assimilate this new knowledge and accelerate learning time. The many mistakes that have been made in the past in designing cellular systems can now be avoided. Engineers who work in other communication systems will appreciate the many diverse concepts used in cellular systems. The reader should be aware that it is possible to apply the various theories improperly and thereby create many serious problems. I would like to hear from readers about their cellular systems experiences, both successful and unsuccessful.

Overall, I have written this book for technical engineers who would like to explore options in the cellular industry. However, Chapters 1 and 2 are for *executives* and for anyone who would like to familiarize himself or herself with key concepts of the field. Chapter 3 describes the specification of cellular systems. The North American specification works in Canada, the United States, and Mexico, so a cellular phone will work anywhere in this territory because of the standardized specification.

Chapter 4 introduces the point-to-point model I developed over the last 15 years. It can be used as a core to develop many design tools. Chapters 5 and 6 deal with cochannel interference problems, and Chapter 7 deals with non-cochannel interference problems. Chapters 8 through 13 offer detailed material for engineers to solve problems concerning improved system performance. Chapter 14 describes the digital systems which may become the next-gener-

ation cellular systems, and presents many key issues in order to alert readers to possible future developments. Chapter 15 highlights some miscellaneous topics related to cellular systems.

Much of my unpublished work is included in these 15 chapters. I welcome feedback from readers about how I can better meet their needs in the second edition of the book.

I have always felt that cellular technology should be openly shared by cellular operators. Competition only occurs in a saturated market, and the cellular market is almost unlimited. Therefore, competition is not to be feared in this early stage of the cellular industry. We need to promote this industry as much as possible by involving more interested engineers and investors.

In the last six years, I have taught 3-day seminars sponsored by George Washington University. I am trying to convince the cellular industry that if we have narrow-minded attitudes and do not share our experiments or knowledge, the whole industry will not advance fast enough and could be replaced by other new industries, such as wireless communications or in-building communications.

Let us join together to allow the cellular industry its optimum potential and set our goal that one day a pocket cellular phone will carry our calls to any place in the world.

*William C.Y. Lee*

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# Acknowledgments

I would like to sincerely thank all the engineers who took my seminars sponsored by George Washington University in the last six years and who stimulated many valuable thoughts for this book.

I still and always will remember the valuable advice and encouragement that C. C. Cutler and Frank Blecher gave me at different times in my career. Bell Laboratories and ITT have provided me the opportunity to study mobile cellular systems during a system-development stage. PacTel Cellular Inc., and Cellular Telecommunications Industrial Association have provided me with much information for the system implementation stage. I want to thank my colleagues who have been associated with my work during these two stages. Above all, I want to thank Phil Quigley and Gloria Everett, who provided me the opportunity of joining PacTel Cellular and dealing with cellular technologies.

I am deeply grateful to Ms. Ella Saunders who has been so helpful in typing this manuscript and to George McClure who patiently reviewed it and gave many valuable suggestions.

This is the third book which I have written in my leisure time. Of course, I have tried to convince my family and especially my lovely wife how important this book is for the cellular industry. Although my family does not believe a word of it, they have generously supported me in making this book possible. I am gratefully obliged to my wife, Margaret, and our two daughters, Betty and Lily.

The first edition of this book was published in 1989. In the last five years, the wireless communications field has changed very rapidly. A lot of new material had to be included in this book. During the revising stage of this book AirTouch's Librarian, Ms. Maribeth Eisenmann, enthusiastically gathered new information for my book. Ms. Susan Shaffer was so patient in typing and proofreading the manuscript for the new additional sections in the old chapters and three new chapters.

When attending the PIMRC Conference in Haag, Netherlands, in October 1994, my briefcase was stolen in the train station which contained some of my manuscript that had to be rewritten. Fortunately, most of the material had been duplicated so the publication date did not slip.

Finally, I would like to thank my family and especially my wife, Margaret, for their understanding while writing this second edition and to the readers who are so supportive of my book.

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# Mobile Cellular Telecommunications