

*Wireless Positioning Technologies and Applications*, by Alan Bensky. 2008. Artech House. ISBN-13: 978-1-59693-130-5. 305 p.

—Reviewed by Landon Blake

## Introduction

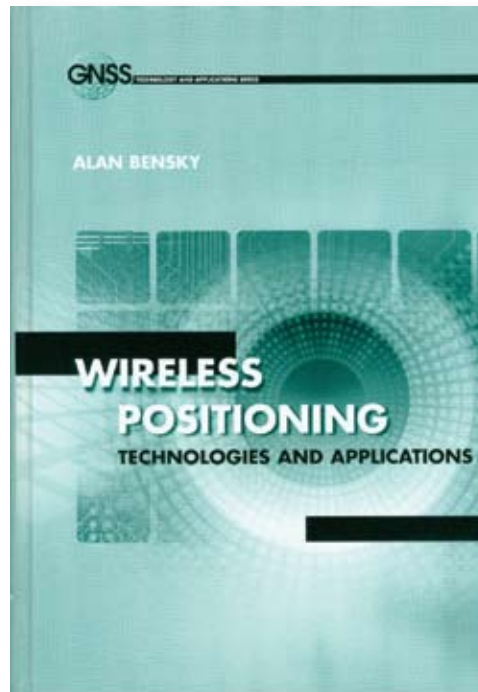
Perhaps the most familiar application of establishing position with wireless technology is the Global Positioning System. However, there are other applications of this same technology, such as cellular network location, and short-range wireless networks. *Wireless Positioning Technologies and Applications* examines the principles underlying various applications of wireless positioning and examines the applications themselves.

## Chapter Contents

The first chapter of *Wireless Positioning* discusses the basic measurements used in wireless positioning, including received signal strength (RSS), time of flight (TOF), and angle of arrival (AOA) [or direction of arrival (DOA)]. The chapter also defines other basic terms needed to understand the material in the remainder of the book. A definition of terms is followed with a brief overview of some wireless positioning applications. These include cellular networks, person and asset tracking, wireless network security, location-based advertising, and location services for vehicles and traffic. The chapter concludes with an overview of procedures for distance measurement in establishing location with basic measurements. This first chapter is light on mathematical formulas and should be easy reading for most professionals in the surveying and mapping professions.

The next four chapters of the book examine the properties of energy waves at the heart of wireless positioning and the systems used to process them. Chapter 2 (Basic Principles and Applications) discusses the parameters of the energy waves used in wireless positioning and examines such navigation systems as LORAN-C and GPS. Chapter 3 (Spread Spectrum) discusses ways of increasing the ranging accuracy of radio signals. Chapter 4 (Time Transfer) discusses the role of time in wireless positioning. Chapter 5 (Multi-Carrier Phase Measurement) examines a wireless positioning system in which measurement of distance does not depend on time but on measuring different characteristics of the radio signal itself.

Chapters 6, 7, and 8 provide a detailed examination of the three basic measurements discussed in Chapter 1. Chapter 6



discusses received signal strength, while Chapter 7 focuses on time of arrival (or time difference of arrival). Chapter 8 is concerned with the angle of arrival.

Chapter 9 examines cellular networks and their role in wireless positioning systems. It includes a discussion of location-based services on cellular networks and provides an overview of cellular network fundamentals. Chapter 10 examines two other applications of wireless positioning, short range wireless networks and RFID. The wireless networks described in Chapter 10 all operate on low-power and over relatively short distances (100 meters or less). Chapter 11 discusses the use of ultra-wide-band radio signals in

wireless positioning which can provide greater positional accuracy but are also more heavily regulated/restricted.

## Book Format and Style

Except for Chapter 1, the book contains an ample supply of mathematical formulas, charts, and diagrams. Each chapter begins with an overview of the topics to be discussed and ends with a conclusion summarizing these topics. A comprehensive list of references is included at the end of each chapter, providing the “wired-in-wireless” reader with an opportunity for accessing more material on the topics being discussed.

## Conclusion

Land surveyors and other mapping professionals can use *Wireless Positioning* to become more familiar with some of the basic principles behind distance measurement and the establishment of position through GPS and LORAN and other technologies. Some of the principles discussed in the book would even apply to distance measurement using technologies not discussed in the book. This would include distance measurement using a total station’s EDM or airborne LIDAR. The book would help surveying and mapping professionals understand the difference in the two main types of terrestrial laser scanners, phase-based and time-of-flight based.

However, engineering and programming professionals are the professionals who will benefit the most from this book. Its detailed diagrams and mathematical formulas are a good foundation for the creation of hardware and software that supports or utilizes wireless positioning. In this sense, much of the book's content may not be of interest to those mapping professional not involved in the design and implementation of wireless positioning.

Although the book contains many diagrams, there are few other illustrations, and the inclusion of a couple of photographs in each chapter would have made the book more visually appealing. A discussion of the application of wave measurement in such technologies as LIDAR and terrestrial surveying equipment would have made the book more applicable to the surveying professional. One could argue that such material would have been beyond the scope of a book on wireless positioning technology, but since *Wireless Positioning* already contains a comprehensive discussion of the same principles underlying distance measurement with waves of energy (either light or radio), an examination of additional technologies would have made the book applicable to a much larger audience.

To fully understand the material in the book one needs a basic understanding of energy waves and the mathematics used to describe and model them. A basic understanding of digital circuits and the way in which energy waves (analog signals) are converted to digital signals would also be needed. Had this information been included as appendices to the book, then

the book could have been a "stand-alone" text on the subject of wireless positioning. I expect the author would have handled these basic subjects in appendices with the same excellent teaching technique that he used in the first chapter. The book would then have been worth the purchase for anyone with little experience and, indeed, background in wireless positioning.

Despite these few areas for improvement, I have found no other book that would allow the interested professional to move beyond basic concepts of wireless positioning technology to the details needed to actually understand the hardware and software that makes the technology work. This book goes into more technical detail than the excellent book *GPS for Land Surveyors* (published by CRC and written by Van Sickle), but it is much easier to understand than textbooks such as *Fundamentals of Global Positioning System Receivers* and *GPS, Inertial Navigation, and Integration* (both published by Wiley Inter-Science). This book strikes a good middle ground between these two ends of the spectrum. If you are a surveyor who enjoyed *GPS for Land Surveyors* and want to move your understanding of wireless positioning technology up a notch, consider acquiring a copy of *Wireless Positioning Technologies and Applications*.

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