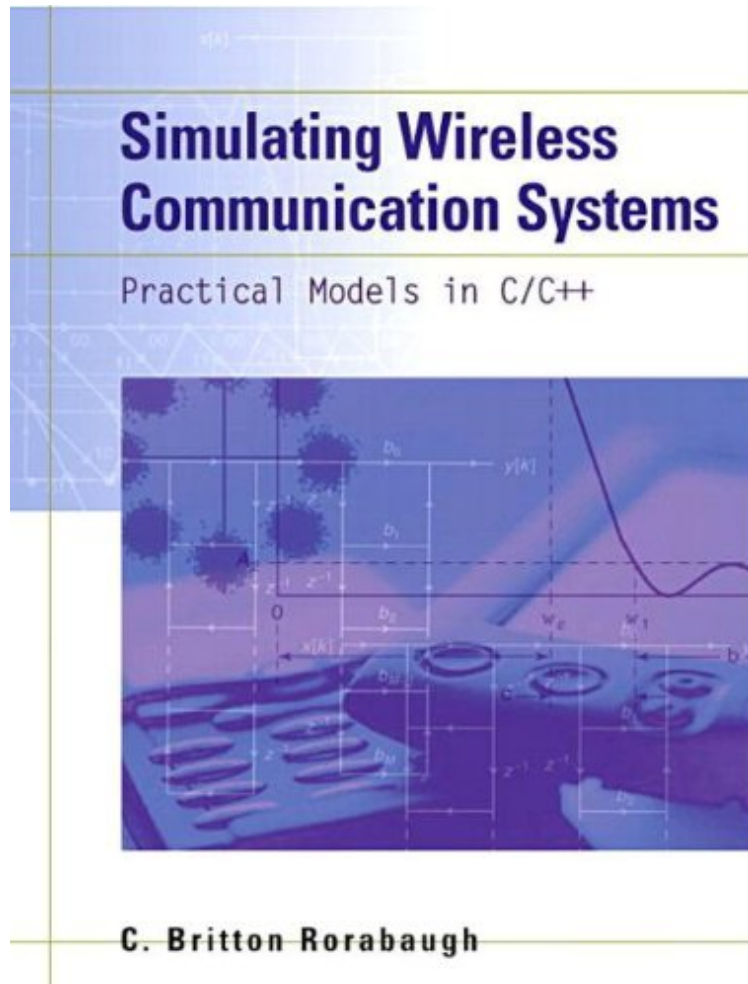


# Simulating Wireless Communication Systems: Practical Models In C++

*C. Britton Rorabaugh*

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practical designs must first be tested and honed using simulation. Author C. Britton Rorabaugh brings to the table more than 20 years of experience simulating large, state-of-the-art communications systems. In *Simulating Wireless Communication Systems*, Rorabaugh explores, using C++, practical and authoritative techniques for simulating even the most complex wireless communication systems. Along the way he shows you how to create custom simulations that fit your project's intended design, so that you and your engineering team aren't forced to resort to inadequate commercial simulation packages. This book includes nearly two hundred models of practical devices for implementing wireless communication systems and major subsystems. Mathematical and statistical appendices are also included to provide useful information for those seeking to understand, set up, and use any of Rorabaugh's detailed device models. Contents include: A background and overview of simulation Discussion of a variety of model types, including Random Process, Filter, and Channel models Practical modulation and demodulation Synchronization, signal shifting, and recovery Detailed instructions for working with Galois fields A comprehensive companion Web site featuring dozens of ready-to-run software modules If you're an engineer or wireless communication project manager, then *Simulating Wireless Communication Systems: Practical Models in C++* will prove to be both a convenient reference and an ideal instructional manual for the creation of specialized wireless communication simulations that will enable you to bring your product to market in a cost-effective and efficient manner. C. BRITTON RORABAUGH has a BS and MS in Electrical Engineering from Drexel University and currently holds the position of Chief Scientist for a company that develops and manufactures specialized military communications equipment. He is the author of several publications on topics such as DSP, Digital Filters, and Error Coding and has experience in object-oriented design, realtime software, numerical methods, computer graphics, C++, C, SPW, MATLAB, Visio, TEX/LATEX, Microsoft Office, and assembly languages for various microprocessors and DSP devices. ISBN: 0-13-022268-2 PRENTICE HALL Professional Technical Reference Upper Saddle River, NJ 07458 www.phptr.com Copyright Pearson Education. All rights reserved.

From the Back Cover *Simulating Wireless Communication Systems: Practical Models in C++* C. Britton Rorabaugh The practical, inclusive reference for engineers simulating wireless systems In order to keep prices within reach of the average consumer, cellular phone and wireless data transceiver manufacturers resort to mass producing millions of units from a single design. Considering the design complexity and fabrication expense involved, typical prototyping is not practical designs must first be tested and honed using simulation. Author C. Britton Rorabaugh brings to the table more than 20 years of experience simulating large, state-of-the-art communications systems. In *Simulating Wireless Communication Systems*, Rorabaugh explores, using C++, practical and authoritative techniques for simulating even the most complex wireless communication systems. Along the way he shows you how to create custom simulations that fit your project's intended design, so that you and your engineering team aren't forced to resort to inadequate commercial simulation packages. This book includes nearly two hundred models of practical devices for implementing wireless communication systems and major subsystems. Mathematical and statistical appendices are also included to provide useful information for those seeking to understand, set up, and use any of Rorabaugh's detailed device models. Contents include: A background and overview of simulation Discussion of a variety of model types, including Random Process, Filter, and Channel models Practical modulation and demodulation Synchronization, signal shifting, and recovery Detailed instructions for working with Galois fields A comprehensive companion Web site featuring dozens of ready-to-run software modules If you're an engineer or wireless communication project manager, then *Simulating Wireless Communication Systems: Practical Models in C++* will prove to be both a convenient reference and an ideal instructional manual for the creation of specialized wireless communication simulations that will enable you to bring your product to market in a cost-effective and efficient manner. C. BRITTON RORABAUGH has a BS and MS in Electrical Engineering from Drexel University and currently holds the position of Chief Scientist for a company that develops and manufactures specialized military communications equipment. He is the author of several publications on topics such as DSP, Digital Filters, and Error Coding and has experience in object-oriented design, realtime software, numerical methods, computer graphics, C++, C, SPW, MATLAB, Visio, TEX/LATEX, Microsoft Office, and assembly languages for various microprocessors and DSP devices. ISBN: 0-13-022268-2 PRENTICE HALL Professional Technical Reference Upper Saddle River, NJ 07458 www.phptr.com Copyright Pearson Education. All rights reserved. About the Author C. BRITTON RORABAUGH has a BS and MS in Electrical Engineering from Drexel University and currently holds the position of Chief Scientist for a company that develops and manufactures specialized military communications equipment. He is the author of several publications on topics such as DSP, Digital Filters, and Error Coding and has experience in object-oriented design, realtime software, numerical methods, computer graphics, C++, C, SPW, MATLAB, Visio, TEX/LATEX, Microsoft Office, and assembly languages for various microprocessors and DSP devices. Excerpt. Reprinted by permission. All rights reserved. Modern communications systems and the devices operating within these systems would not be possible without simulation, but practical information specific to the simulation of communications systems is relatively scarce. My motive for writing this book was to collect and capture in a useful form the techniques that can be used to simulate a wireless communication system using C++. It has been my experience that organizations newly confronted with a need to

simulate a communication system are in a rush to get started. Consequently, these organizations will purchase a commercial simulation package like SPW or MATLAB Simulink without even considering the alternative of constructing their own simulation using C++. In the beginning, progress comes quickly as simple systems are configured from standard library models. Only when they begin to model the more complex proprietary parts of their systems do these organizations begin to realize how much control and flexibility they sacrificed in going with a commercial package. It is not possible for any library of precoded models to be absolutely complete. There will always be a need to build a highly specialized model or make modifications to existing models. A user attempting to do either, using a commercial package, usually spends more time dealing with the rules and limitations of the simulation infrastructure than with the details of the model algorithms themselves. In the mid 1990s, I was the architect and lead designer for a proprietary simulation package that was used to simulate the wireless data communication links in several very large U.S. defense systems. This package wasnt perfectsoftware never isbut I drew upon this experience, and while writing this book, I developed a simpler simulation package that avoids many of the complexities and objectionable features of my earlier effort. This new package is called PracSim, which is short for Practical Simulation. All of the source code for the models and infrastructure comprising the PracSim package is provided on the Prentice Hall Web site (<http://authors.phptr.com/rorabaugh/>). Examples of this code are presented and discussed throughout the book, but there is far too much code to include it all in the text. The library of PracSim models is not intended to be complete, but rather to provide a foundation that users can modify or build upon as needed to capture the nuances of the particular systems they are attempting to model. I didnt keep accurate records, but Im sure that construction of the PracSim software took far more time than the actual writing of the text. I would like to thank my wife Joyce, son Geoffrey, daughter Amber, and mother-in-law Eleanor for not complaining too much about all the time I spent on this project and for dealing with all of the household problems that I never seemed to have time for. I would also like to thank my editor, Bernard Goodwin, for his patience despite the numerous times that I postponed delivery of the final manuscript. 0130222682P08062004