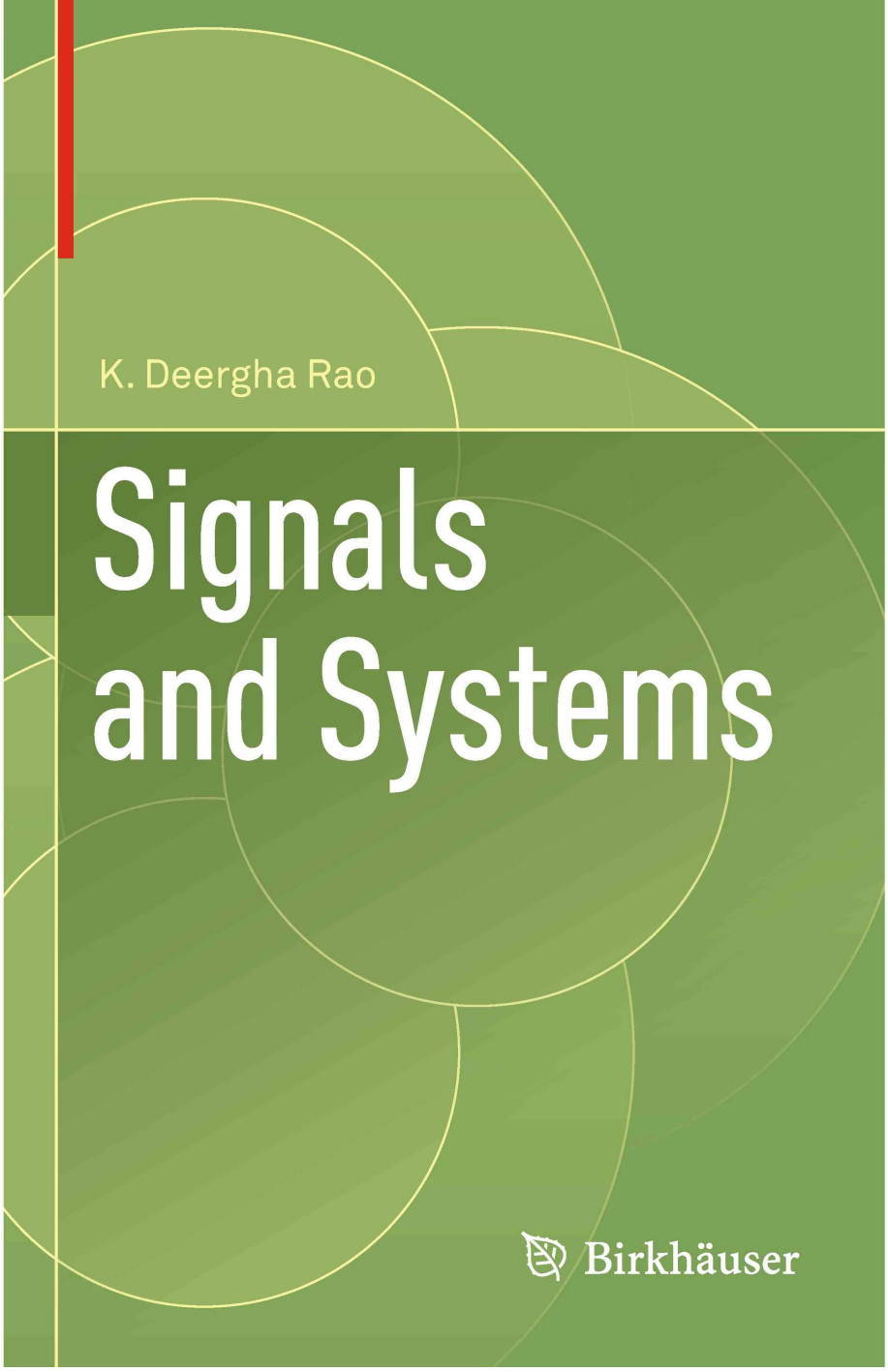
K. Deergha Rao
Signals and Systems
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मातृभ्यो नमः
पितृभ्यो नमः
गुरुभ्यो नमः

To
My Parents Dalamma and Boddu,
My Beloved Wife Sarojini,
and
My Mentor Prof. M.N.S. Swamy

Preface

The signals and systems course is not only an important element for undergraduate electrical engineering students but the fundamentals and techniques of the subject are essential in all the disciplines of engineering. Signals and systems analysis has a long history, with its techniques and fundamentals found in broad areas of applications. The signals and systems is continuously evolving and developing in response to new problems, such as the development of integrated circuits technology and its applications.

In this book, many illustrative examples are included in each chapter for easy understanding of the fundamentals and methodologies of signals and systems. An attractive feature of this book is the inclusion of MATLAB-based examples with codes to encourage readers to implement exercises on their personal computers in order to become confident with the fundamentals and to gain more insight into signals and systems. In addition to the problems that require analytical solutions, MATLAB exercises are introduced to the reader at the end of some chapters.

This book is divided into 8 chapters. Chapter 1 presents an introduction to signals and systems with basic classification of signals, elementary operations on signals, and some real-world examples of signals and systems. Chapter 2 gives time-domain analysis of continuous time signals and systems, and state-space representation of continuous-time LTI systems. Fourier analysis of continuous-time signals and systems is covered in Chapter 3. Chapter 4 deals with the Laplace transform and analysis of continuous-time signals and systems, and solution of state-space equations of continuous-time LTI systems using Laplace transform. Ideal continuous-time (analog) filters, practical analog filter approximations and design methodologies, and design of special class filters based on pole-zero placement are discussed in Chapter 5. Chapter 6 discusses the time-domain representation of discrete-time signals and systems, linear time-invariant (LTI) discrete-time systems and their properties, characterization of discrete-time systems, and state-space representation of discrete-time LTI systems. Representation of discrete-time signals and systems in frequency domain, representation of sampling in frequency domain, reconstruction of a band-limited signal from its samples, and sampling of discrete-time signals are

detailed in Chapter 7. Chapter 8 describes the z-transform and analysis of LTI discrete-time systems, the solution of state-space equations of discrete-time LTI systems using z-transform, and transformations between the continuous-time systems and discrete-time systems.

The salient features of this book are as follows:

- Provides introductory and comprehensive exposure to all aspects of signal and systems with clarity and in an easy way to understand.
- Provides an integrated treatment of continuous-time signals and systems and discrete-time signals and systems.
- Several fully worked numerical examples are provided to help students understand the fundamentals of signals and systems.
- PC-based MATLAB m-files for the illustrative examples are included in this book.

This book is written at introductory level for undergraduate classes in electrical engineering and applied sciences that are the prerequisite for upper level courses, such as communication systems, digital signal processing, and control systems.

Hyderabad, India K. Deergha Rao

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