Preface

I hear and I forget. I see and I remember. I do and I understand.—Confucius

This is a signals and systems textbook with a difference: *Engineering applications of signals and systems are integrated into the presentation as equal partners with concepts and mathematical models,* instead of just presenting the concepts and models and leaving the student to wonder how it all is related to the world of engineering.

This textbook is designed for a sophomore-level or early-junior-level introductory course on signals and systems. The continuous-time material of Chapters 1 through 6 can be covered in a one-semester course. The entire textbook can be covered in two quarters; a division point could be before the introduction of Fourier series and transforms in Chapter 5. Material on circuit frequency response, active filters, and **s**-domain circuit analysis may have been covered in introductory circuits courses, but our experience has been that these topics are often not covered in those courses, so they are included in this textbook. Hence, some of the circuits-related material overlaps and occasionally duplicates some sections of *Circuits* by Ulaby and Maharbiz.

Following the first two chapters on basics of signals and LTI systems, the book is structured such that odd-numbered chapters present theory, and each even-numbered chapter presents applications of the theory presented in the chapter that preceded it.

Applications

The ***systems applications*** presented in this textbook include: spring-mass-damper automobile suspension systems, **s**-domain circuit analysis, electromechanical analogs with specific application to a biomechanical model, oven temperature control, motor system control, and inverted pendulum control.

Signals applications include: implementation of a notch filter to remove an interfering tone from the sound of a trumpet (which inspired the idea for the book cover), implementation of a comb filter to eliminate one of two trumpets playing two different notes simultaneously, and implementation of a resonator filter to remove most of the noise from a noisy trumpet signal. These signals applications are repeated using discrete-time signal processing, along with dereverberation, deconvolution (both real-time and batch), DFT-based noise filtering, and use of the DFT to compute spectra of both periodic (the trumpet signal) and non-periodic signals.

It amazes one of us (AEY) that almost all books on signal processing, even discrete-time signal processing, simply present the mathematical theory of the topic and show various methods for designing filters without ever explaining what they are for, let alone implementing them. Studying signal processing without filtering real-world signals is like studying a cookbook without ever turning on an oven or even a stove. This textbook implements the techniques presented on an actual trumpet signal (due to its simplicity and for unity

of presentation) and *provides the software programs so that students can experiment with altering parameters and see for themselves how the techniques work.*

CD Contents

The CD contains the following:

1. A detailed set of solutions to all of the exercises.
2. A detailed description of each computer-based example, including program listing and sample output plot.
3. Waveforms in .mat format for a real-world trumpet playing note B, two trumpets simultaneously playing notes G and A, other waveforms of this type, and some waveforms for homework problems.
4. Copies of all book figures, tables, and highlighted equations.