Smartphone-Based Real-Time Digital Signal Processing

Second Edition

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ISBN: 978-3-031-01412-3 paperback
ISBN: 978-3-031-02540-2 ebook
ISBN: 978-3-031-00333-2 hardcover

DOI 10.1007/978-3-031-02540-2

A Publication in the Springer series
SYNTHESIS LECTURES ON SIGNAL PROCESSING

Lecture #16
Series Editor: Joseé Moura, *Carnegie Mellon University*
Series ISSN
Print 1932-1236 Electronic 1932-1694

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Nasser Kehtarnavaz, Abhishek Sehgal, and Shane Parris
University of Texas at Dallas

SYNTHESIS LECTURES ON SIGNAL PROCESSING #16

ABSTRACT

Real-time or applied digital signal processing courses are offered as follow-ups to conventional or theory-oriented digital signal processing courses in many engineering programs for the purpose of teaching students the technical know-how for putting signal processing algorithms or theory into practical use. These courses normally involve access to a teaching laboratory that is equipped with hardware boards, in particular DSP boards, together with their supporting software. A number of textbooks have been written discussing how to achieve real-time implementation on these hardware boards. This book discusses how to use smartphones as hardware boards for real-time implementation of signal processing algorithms as an alternative to the hardware boards that are used in signal processing laboratory courses. The fact that mobile devices, in particular smartphones, have become powerful processing platforms led to the development of this book enabling students to use their own smartphones to run signal processing algorithms in real-time considering that these days nearly all students possess smartphones. Changing the hardware platforms that are currently used in applied or real-time signal processing courses to smartphones creates a truly mobile laboratory experience or environment for students. In addition, it relieves the cost burden associated with using dedicated signal processing boards noting that the software development tools for smartphones are free of charge and are well-maintained by smartphone manufacturers. This book is written in such a way that it can be used as a textbook for real-time or applied digital signal processing courses offered at many universities. Ten lab experiments that are commonly encountered in such courses are covered in the book. This book is written primarily for those who are already familiar with signal processing concepts and are interested in their real-time and practical aspects. Similar to existing real-time courses, knowledge of C programming is assumed. This book can also be used as a self-study guide for those who wish to become familiar with signal processing app development on either Android or iPhone smartphones. A zipped file of the codes discussed in the book can be acquired from this third-party website `http://sites.fastspring.com/bookcodes/product/SignalProcessingBookcodesSecondEdition` .

KEYWORDS

smartphone-based signal processing, real-time signal processing using smartphones, smartphones as signal processing boards

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Preface

Real-time or applied digital signal processing courses are offered as follow-up courses to conventional or theory-oriented digital signal processing courses in many electrical engineering curricula. The purpose of offering real-time or applied digital signal processing courses is to enable students to bridge the gap between signal processing theory and implementation aspects.

A typical real-time or applied digital signal processing course is normally held within the confines of a teaching laboratory room that is equipped with implementation hardware platforms and the accompanying software for those platforms. The fact that mobile devices, in particular smartphones, have become powerful processing platforms led to the development of this book toward enabling students to use their own smartphones as implementation platforms for running signal processing algorithms as apps considering that these days nearly all students possess smartphones. Changing the hardware platforms that are normally used in real-time applied signal processing courses to smartphones creates a truly mobile laboratory experience or environment for students. In addition, it relieves the cost burden associated with using dedicated signal processing hardware boards noting that the software development tools for smartphones are free of charge and are well-maintained by smartphone manufacturers.

This book is written in such a way that it can be used as a textbook for real-time or applied digital signal processing courses offered at many universities. Ten lab experiments that are commonly encountered in such courses are covered in the book. This book is written primarily for those who are already familiar with signal processing concepts and are interested in their real-time and practical aspects. Similar to existing real-time courses, knowledge of C programming is assumed. This book can also be used as a self-study guide for those who wish to become familiar with signal processing app development on either Android or iPhone smartphones. In this second edition, various updates are made to reflect the newer versions of the software tools used in the first edition.

The smartphone-based approach covered in this book eases the constraint of a dedicated signal processing laboratory for the purpose of offering applied or real-time signal processing courses as it provides a truly mobile platform for implementation of signal processing algorithms. A zipped file of the codes discussed in the book can be acquired from this third-party website `http://sites.fastspring.com/bookcodes/product/SignalProcessingBookcodesSecondEdition`.

As a final note, I would like to thank my co-authors and ex-students, Abhishek Sehgal and Shane Parris, for their contributions, in particular for the development of the lab codes, in the first and second editions of this book.

Nasser Kehtarnavaz
November 2018