DIGITAL SIGNAL PROCESSING APPLICATIONS

USING THE ADSP-2100 FAMILY

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Analog-Digital Conversion Handbook
Digital Signal Processing in VLSI
Digital Signal Processing Applications Using the ADSP-2100 Family

Published by Analog Devices

Nonlinear Circuits Handbook
Transducer Interfacing Handbook
Synchro & Resolver Conversion

DIGITAL SIGNAL PROCESSING APPLICATIONS

USING THE ADSP-2100 FAMILY

by

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Preface

This book is about bridging the gap between digital signal processing (DSP) algorithms and their real-world implementations on state-of-the-art digital signal processors. Each chapter tackles a specific application topic, briefly describing the algorithm and discussing its implementation on the ADSP-2100 family of DSP chips.

Anyone who wants to understand how a processor optimized for digital signal processing, such as the ADSP-2100, is used to solve a particular problem will find this book informative. The areas addressed include but are not limited to traditional signal processing, since graphics and numerical applications also benefit from the features of a DSP processor.

We do not attempt to explain the signal processing theory of any application in full detail. Our readers are assumed to already understand the theory and practice applying to their own areas of interest. *Digital Signal Processing in VLSI**, a companion book in the Analog Devices technical reference set, provides much of the necessary basics. The references listed at the end of each chapter provide a wealth of additional information.

This volume spans topics ranging from the very simple to the moderately complex. Here is a brief summary of each section's contents:

- *Fixed-point arithmetic operations*

  How basic fixed-point arithmetic operations are mapped onto the hardware of the ADSP-2100.

- *Floating-point arithmetic operations*

  How to convert from fixed-point to floating-point representation and vice versa and how to perform basic floating-point arithmetic operations using the ADSP-2100. *Block floating-point* operations are discussed in the chapter on fast Fourier transforms.

- *Function approximations*

  How to perform numerical approximations of some useful functions.

- *Digital filters*

  Implementations of several finite impulse-response (FIR) and infinite impulse-response (IIR) filters that have fixed coefficients. Also described are multirate

filters, which change the sampling rate of digitally represented signals. This section also discusses adaptive filters (with time-varying coefficients).

- *One-dimensional fast Fourier transforms*

  Implementations of several one-dimensional fast Fourier transform (FFT) algorithms and the related operations of bit reversal, digit reversal, block floating-point scaling, and windowing. How to optimize the FFT programs for speed.

- *Two-dimensional fast Fourier transforms*

  An implementation of an FFT in two dimensions.

- *Image processing*

  Implementations of several algorithms used in processing digitized images.

- *Graphics*

  A graphics subsystem based on the ADSP-2100, complete with all software routines and support circuitry.

- *Linear predictive speech coding*

  Techniques used to analyze, encode, and synthesize speech signals.

- *Pulse code modulation*

  An ADSP-2100 implementation of the CCITT standard pulse-code modulation (PCM) algorithm. Encoding and decoding are shown, employing both μ-law and A-law companding methods.

- *Adaptive differential pulse code modulation (ADPCM)*

  An ADSP-2100 implementation of the CCITT standard ADPCM algorithm. A non-standard program that is suitable for some applications is also described.

- *Modem algorithms*

  Several algorithms used in implementing high-speed modems.

- *Dual-tone multifrequency coding (DTMF)*

  How to generate and detect the CCITT standard DTMF signals.

- *Sonar beamforming*

Both software and hardware for a digital beamforming system for passive sonar.

- *Memory interface*

  A design example that shows considerations for implementing an interface between the ADSP-2100 and various types of memory and I/O.

- *Multiprocessing*

  An interface between two ADSP-2100s operating in parallel. Dual-port memory and software issues are addressed.

- *Host interface*

  How to use the ADSP-2100 as a coprocessor to a host CPU, using the Motorola 68000 as an example.

The text provides comprehensive source-code listings, complete with comments and accompanied by explanatory text. A supplementary diskette—furnished with the book—contains the program listings.

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* Higgins, Richard J. 1990. *Digital Signal Processing in VLSI*. Englewood Cliffs, NJ: Prentice-Hall.