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Abstract

This book is an introduction to the basic principles of discrete signal processing with applications in biomedicine. The goal of the book is not a presentation of all the processes and methods of signal processing, which are also presented in dozens of academic books, but rather their deeper understanding through their implementation in an algorithmic way in a programming language. The book, in its first part, introduces the reader to general concepts of signals, with a focus on medical signals. Then, after introducing basic discrete signal generation functions, basic signal processing concepts are presented, namely convolution, correlation, and Fourier transform. At the same time, applications are being developed using the above procedures, mainly in signal filtering, both in the time and in the frequency domains. The examples used refer mainly to medical signals and images. The second part of the book includes a series of comprehensive laboratory exercises, involving the implementation in a programming language of the theoretical signal processing concepts developed in the first part. Each exercise consists of a brief theory, with the basic knowledge that the student must know in order to carry out the laboratory course followed by solved examples of the concepts of the course with progressive difficulty, and finally topics for practice are included, the solutions of which are at the end of the book. The MATLAB environment was chosen for the implementation of the programs in the book, due to both the simplicity and ease of coding, as well as its great penetration in engineering, both in academic and research as well as in a development environment. However, as the goal of the book is to gain a deeper understanding of the signal processing methods being developed, ready-made MATLAB functions for signal processing are generally not used. Instead, the code is developed using simple algorithmic structures, common to most widely used programming languages.