

Preface

In our contemporary world, the digital processing of signals and data is certainly very important. Most people are now using it, as it is involved in mobile communications, TV and radio, GPS, medical instruments, transportation and traffic, and a long et cetera. Also, most branches of technical development and research are intrinsically connected to signals and data processing.

This book is the first of a trilogy. Our desire is to provide a concise and relatively complete exposition of signal processing topics, and a guide for personal practical exploration based on MATLAB programs. It has been said by many experts on learning that readings could be forgotten, but experiments leave a mark in our minds and help to gain significant insights.

The books include MATLAB programs to illustrate each of the main steps of the theory. The code has been embedded in the text; with the purpose of showing how to put into practice the ideas and methods being proposed.

It seems opportune to say some words on the author's experience in the field of signal and data processing. Since 30 years ago I belong to the Faculty of Physics, University Complutense of Madrid, Spain. My research concerns automatic control and robotics, with applications in autonomous vehicles, maritime drones, chemical processes, satellites, and others. During the research a variety of sensors has been used, for the measurement of gases, pH, forces, light, magnetic fields, evoked human potentials, etc. More complex sensors, like GPS or cameras, have also been employed. Currently I teach Biomedical Digital Signal Processing, and Digital Signal Processing for New Technologies.

The motivation for elaborating this book is related to our interaction with students and young researchers. Our teaching includes theory classes and laboratory exercises. It was noticed in laboratory that the use of MATLAB and its Signal Processing Toolbox has noticeable initial difficulties for the students, if they had to start from scratch. Therefore, we began to provide them some simple programs that give them initial success, and graphical results. A good start encourages the students for further study steps, and helps to develop a more ambitious teaching.

This book is divided into three parts. The first part introduces periodic and non-periodic signals. The second part is devoted to filtering, which is an important

and most usual application. The third part contemplates topics that could be considered as advanced; one tries to analyze, with several purposes, what happens with signals and data from real life, like for example fatigue of structures, earthquakes, electro-encephalograms, animal songs, etc. Therefore, the third part focuses on non-stationary signals. The last chapter is devoted to modulation, which implies the intentional use of non-stationary signals, and so this chapter belongs to the third part.

The book has two appendices. The first appendix is devoted to the Fourier transform, other transforms, and sampling fundamentals. The second contains long programs, which are put here in order to make the chapters more readable.

Concerning the MATLAB programs, the programming style is purposively simple and illustrative. We tried to avoid coding ways that could be more optimized but may result in obscuring the ideas behind. The programs work in the diverse MATLAB versions, with perhaps some possible changes for some functions (in this case, MATLAB itself suggests appropriate changes).

There are traditional books that could be used for consultation. The chapters include references to these books and pertinent scientific papers. Most of the papers are available from Internet. By the way, we have to show our gratitude to the public information available from Internet, from web sites, academic institutions, encyclopedia, etc. All chapters have a final section with some convenient Internet links.

The reader is invited to typeset the programs included in the book, for it would help for catching coding details. Anyway, all programs are available from the book web page: www.dacya.ucm.es/giron/SPBook1/Programs.

Please, send feedback and suggestions for further improvements and support.

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1

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