

Preface

The fast growth of the technological resources observed nowadays has triggered the development of new DSP techniques to cope with the requirements of modern industry. The research of efficient algorithms to be used in the ever-increasing applications of adaptive filters has therefore developed tremendously. In such a scenario, the QRD-RLS-based algorithms are a good option in applications where speed of convergence is of paramount importance and an efficient, reliable, and numerically robust adaptive filter is needed.

However, I believe that the nice features of this family of algorithms, in many occasions, are not used simply due to the fact that their matrix equations are not easy to understand. On the other hand, students, researchers, and practitioners need to be constantly up-to-date with the recent developments, not only by attending conferences and reading journal papers, but also by referring to a comprehensive compendium, where all concepts were carefully matured and are presented in such a way as to provide easy understanding. This is the main goal of this book: To provide the reader with the necessary tools to understand and implement a variety of QRD-RLS algorithms suitable to a vast number of applications.

This publication gathers some of the most recent developments as well as the basic concepts for a complete understanding of the QRD-RLS-based algorithms. Although this work does not cover all fronts of research in the field, it tries to bring together the most important topics for those who need an elegant and fast-converging adaptive filter.

QR decomposition has been a pearl in applied mathematics for many years; its use in adaptive filtering is introduced in the first chapter of this book in the form of an annotated bibliography.

The fundamental chapters materialized from lecture notes of a short course given at Helsinki University of Technology in the winter of 2004–2005, a number of conference and journal publications, and some theses I supervised. I was also lucky to receive contributions from many prominent authorities in the field.

This book consists of 12 chapters, going from fundamentals to more advanced aspects. Different algorithms are derived and presented, including basic, fast, lattice, multichannel, and constrained versions. Important issues, such as numerical

stability, performance in finite-precision environments, and VLSI oriented implementations are also addressed. All algorithms are derived using Givens rotations, although one chapter deals with implementations using Householder reflections.

I hope the readers will find this book a handy guide to most aspects of theory and implementation details, quite useful in their professional practice. Upon request to the editor, a set of MATLAB[®]¹ codes for the main algorithms described in this book would be available.

Finally, I express my deep gratitude to all authors for their effort and competence in their timely and high quality contributions. I also thank the people from Springer, always very kind and professional. I am particularly grateful to my former DSc supervisor, Paulo S. R. Diniz, for his support and ability to motivate his pupils, and Marcello L. R. de Campos, the dear friend who, in the middle of a technical meeting on a sunny Friday, suggested this book.

Rio de Janeiro, Brazil
September 2008

José A. Apolinário Jr. D. Sc.
apolin@ieee.org

¹ MATLAB is a registered trademark of The MathWorks, Inc.