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Optimal constrained representation and filtering of signals , Dimitri Kazakos, 1983, , 20 pages. A random signal is observed in independent random noise. The author is addressing the problem of finding the optimum signal estimate that is constrained to lie in a given ....


Code Division Multiple Access Communications , Savo G. Glisic, 1995, , 364 pages. Code Division Multiple Access (CDMA) has become one of the main candidates for the next generation of mobile land and satellite communication systems. CDMA is based on spread ....

Digital signal processing and control and estimation theory points of tangency, areas of intersection, and parallel directions, Alan S. Willsky, 1979, Technology & Engineering, 256 pages. The purpose of this book is to explore several specific areas of research in two distinct but related fields: digital signal processing and modern control and estimation theory ....


To help readers differentiate among the rich collection of estimation methods and algorithms, this book describes in detail many of the important estimation methods and shows how they are intended. Written as a collection of lessons, the book introduces readers to the general field of estimation theory and includes abundant supplementary material. Approximately one half of the
book is devoted to parameter estimation while the other half concentrates on state estimation.

Estimation theory is widely used in many branches of science and engineering. No doubt, one could trace its origin back to ancient times, but Karl Friederich Gauss is generally acknowledged to be the progenitor of what we now refer to as estimation theory. R. A. Fisher, Norbert Wiener, Rudolph E. Kalman, and scores of others have expanded upon Gauss's legacy and have given us a rich collection of estimation methods and algorithms from which to choose. This book describes many of the important estimation methods and shows how they are interrelated.

Estimation theory is a product of need and technology. Gauss, for example, needed to predict the motions of planets and comets from telescopic measurements. This "need" led to the method of least squares. Digital computer technology has revolutionized our lives. It created the need for recursive estimation algorithms, one of the most important ones being the Kalman filter. Because of the importance of digital technology, this book presents estimation from a discrete-time viewpoint. In fact, it is this author's viewpoint that estimation theory is a natural adjunct to classical digital signal processing. It produces time-varying digital filter designs that operate on random data in an optimal manner.

It is this author's viewpoint that, whenever possible, computation should be left to the experts. Consequently, I have linked computation into MATLAB\textregistered (MATLAB is a registered trademark of The MathWorks, Inc.) and its associated toolboxes. A small number of important estimation M-files, which do not presently appear in any MathWorks toolbox, have been included in this book; they can be found in Appendix B.

This book has been written as a collection of lessons. It is meant to be an introduction to the general field of estimation theory and, as such, is not encyclopedic in content or in references. The supplementary material, which has been included at the end of many lessons, provides additional breadth or depth to those lessons. This book can be used for self-study or in a one-semester course.

Each lesson begins with a summary that describes the main points of the lesson and also lets the reader know exactly what he or she will be able to do as a result of completing the lesson. Each lesson also includes a small collection of multiple-choice summary questions, which are meant to test the reader on whether or not he or she has grasped the lesson's key points. Many of the lessons include a section entitledr

``Computation.'' When I decided to include material about computation, it was not clear to me whether such material should be collected together in one place, say at the rear of the book in an appendix, or whether it should appear at the end of each lesson, on demand so to speak. I sent letters to more than 50 colleagues and former students asking them what their preference would be. The overwhelming majority recommended having discussions about computation at the end of each lesson. I would like to thank the following for helping me to make this decision: Chong-Yung Chi, Keith Chugg, Georgios B. Giannakis, John Goutsias, Ioannis Katsavounidis, Bart Kosko, Li-Chien Lin, David Long, George Papavassilopoulos, Michael Safonov, Mostafa Shiva, Robert Scholtz, Ananthram Swami, Charles Weber, and Lloyd Welch.

Approximately one-half of the book is devoted to parameter estimation and the other half to state estimation. For many years there has been a tendency to treat state estimation, especially Kalman filtering, as a stand-alone subject and even to treat parameter estimation as a special case of state estimation. Historically, this is incorrect. In the musical Fiddler on the Roof, Tevye argues on behalf of

``Tradition!'' Estimation theory also has its tradition, and it begins with Gauss and parameter estimation. In Lesson 2 we show that state estimation is a special case of parameter estimation; i.e., it is the problem of estimating random parameters when these parameters change from one time instant to the next. Consequently, the subject of state estimation flows quite naturally from the subject of parameter estimation.
There are four supplemental lessons. Lesson A is on sufficient statistics and statistical estimation of parameters and has been written by Professor Rama Chellappa. Lessons B and C are on higher-order statistics. These three lessons are on parameter estimation topics. Lesson D is a review of state-variable models. It has been included because I have found that some people who take a course on estimation theory are not as well versed as they need to be about state-variable models in order to understand state estimation.

This book is an outgrowth of a one-semester course on estimation theory taught at the University of Southern California since 1978, where we cover all its contents at the rate of two lessons a week. We have been doing this since 1978. I wish to thank Mostafa Shiva, Alan Laub, George Papavassilopoulos, and Rama Chellappa for encouraging me to convert the course lecture notes into a book. The result was the first version of this book, which was published in 1987 as Lessons in Digital Estimation Theory. Since that time the course has been taught many times and additional materials have been included. Very little has been deleted. The result is this new edition. The second group contains problems that are related to the material in the lesson. They range from theoretical to easy computational problems, easy in the sense that the computations can be carried out by hand. The third group contains computational problems that can only be carried out using a computer. Many of the problems were developed by students in my Fall 1991 and Spring 1992 classes at USC on Estimation Theory. For these problems, the name(s) of the problem developer(s) appears in parentheses at the beginning of each problem. The author wishes to thank all the problem developers.

While writing the first edition of the book, the author had the benefit of comments and suggestions from many of his colleagues and students. I especially want to acknowledge the help of Georgios B. Giannakis, Guan-Zhong Dai, Chong-Yung Chi, Phil Burns, Youngby Kim, Chung-Chin Lu, and Tom Hebert. While writing the second edition of the book, the author had the benefit of comments and suggestions from Georgios B. Giannakis, Mithat C. Dogan, Don Specht, Tom Hebert, Ted Harris, and Egemen Gonen. Special thanks to Mitsuru Nakamura for writing the estimation algorithm M-files that appear in Appendix B; to Ananthram Swami for generating Figures B 4, B 5, and B 7; and to Gent Paparisto for helping with the editing of the galley proofs.

Additionally, the author wishes to thank Marcel Dekker, Inc., for permitting him to include material from J. M. Mendel, Discrete Techniques of Parameter Estimation: The Equation Error Formulation), 1973, in Lessons 1--3, 5--9, 11, 18, and 23; Academic Press, Inc., for permitting him to include material from J. M. Mendel, Optimal Seismic Deconvolution: An Estimation-based Approach), copyright 1983 by Academic Press, Inc., in Lessons 11--17, 19--21, and 25; and the Institute of Electrical and Electronic Engineers (IEEE) for permitting him to include material from J. M. Mendel, Kalman Filtering and Other Digital Estimation Techniques: Study Guide}, copyright, 1987 IEEE, in Lessons 1--3, 5--26, and D. I hope that the readers do not find it too distracting when I reference myself for an item such as a proof (e.g., the proof of Theorem 17-1). This is done only when I have taken material from one of my former publications (e.g., any one of the preceding three), to comply with copyright law, and is in no way meant to imply that a particular result is necessarily my own.

I used this book for a class during my PhD in Elec Engr. This book is best read with a second book in statistics and a third on signals close at hand. The concepts are complex and presented in a reasonably brief manner. It packs a lot of punch in a relatively small space. If graduate classes in signal processing and control systems are your bag, this may be the book for you.

I first used this text book in 1980 at USC. At that time, it was only in the form of prepared lecture notes. The current organization of this book is the same as before. New material has been added. I purchased this book because of the new revised material. I find the book to be very systematic. It is an excellent book for personal study of the subject or as a graduate text book. Since 1980, there are some other books that are now available on the subject. But this book stays very relevant and useful as ever. I recommend it highly.
I am a student of the author and I really enjoyed this book along with his lectures. I may not enjoy reading this book without going through the lectures of the author (This is the scenario with many subjects to most students). The book is well written well organized and I benefited a lot from this book.

During the winter 2008 academic quarter I took an introductory class on optimal estimation which relied heavily on this book, covering about 70% of the material. I felt the text gave a great background on optimal estimation, but because I used it in conjunction with an engineering class, I can't really say how great the book would be as, say, a self-study aid. I am disappointed at the price vs. binding ratio for this book, since at $99 I would expect a book like this with no glossy color pictures to be hardcover, whereas it is soft cover. The content of the book itself is great.

The book is divided into many very short chapters, which I really appreciate, since it builds up in small, manageable increments the foundation to more complicated optimal estimation concepts. For example, one chapter will cover Gauss-Markov processes and their properties, while the next will cover Kalman filtering. The homework problems, which aren't too difficult, have a few typos, but it was obvious they were typos. All in all, for me this book provided a clear introduction to optimal estimation, but your mileage may vary if you are using it for self-study.

I don't know after I finished this book. And reading this book is definitely not an enjoyable experience. The worst thing is the writer wrote this book into a math book. The worst of the worst, it's a math book with 'n', 'N', 'k', 'lambda'... all these messed up. It takes unnecessary effort to figure out the dimensions of matrixes and vectors. After all the torture, I cannot find a tiny bit of physical meaning attached behind. The problems are remotely connected with the text. I cannot do the problems after I read the text twice, or I cannot even understand what the problems are talking about. As an engineering student, I believe the underlying essence of any theory is simple. It's the writer used 560 pages to make it complicated and confusing and the student now have to do the reverse work.

This work is protected by local and international copyright laws and is provided solely for the use of instructors in teaching their courses and assessing student learning. Dissemination or sale of any part of this work (including on the World Wide Web) will destroy the integrity of the work and is not permitted. The work and materials from this site should never be made available to students except by instructors using the accompanying text in their classes. All recipients of this work are expected to abide by these restrictions and to honor the intended pedagogical purposes and the needs of other instructors who rely on these materials.

Additionally algorithm applications assume asymptotically basic state-variable model bispectrum coefficients compute consistent estimator continuous-time convergence Corollary correlated covariance matrix deconvolution denote depends derivation determine deterministic differential equation discrete-time distribution eigenvalues estimate of x(k estimation theory example exponential exponential family expressed first-order fixed-interval formula gain matrix Gaussian random given hence higher-order statistics impulse response input jointly Gaussian Kalman gain large-sample properties least-squares estimator likelihood function linear model M-file MAP estimator Markov maximum-likelihood estimates mean-squared estimator measurement equation measurement noise Mendel nonlinear Observe obtain optimal output parameter estimation prediction probability density function problem Proof pseudoinverse random variables random vectors sample scalar second-order Signal Processing singular-value decomposition smoother smoothing solution squares statistically independent steady-state Kalman filter sufficient statistic Supplementary Material Theorem time-varying transfer function unbiased estimator unbiasedness uncorrelated values white noise Wiener filter WLSE zero mean


Jerry Mendel is a professor of electrical engineering at the University of Southern California. He is a fellow of the IEEE and has published close to 400 articles, including 8 books. He has been working in the field of fuzzy logic for 15 years and is the author of Uncertain Rule-Based Fuzzy Logic Systems: Introduction and New Directions (Prentice Hall 2001, ISBN 0-1304-0969-3).

Book Description: Pearson Education Limited, United Kingdom, 1995. Hardback. Book Condition: New. 2nd Revised United States ed. 240 x 180 mm. Brand New Book ***** Print on Demand *****. This book covers key topics in parameter estimation and state estimation, with supplemental lessons on sufficient statistics and statistical estimation of parameters, higher-order statistics and a review of state variable models. It also links computations into MATLAB and its associated toolboxes. A small number of important estimation M-files, which do not presently appear in any MathWork's toolbox, are included in an appendix. Bookseller Inventory # APC9780131209817


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