

Communications and Networks

Communications and Networks

A Survey of Recent Advances

Edited by
Ian F. Blake H. Vincent Poor

With Contributions by
J. Abrahams I.F. Blake H. Derin
A. Ephremides A.H. Haddad Y.F. Huang
Y-C. Jenq M.E. Kanefsky S.A. Kassam C.C. Lee
H.V. Poor P.F. Swaszek S. Tantaratana
D. Tjøstheim J.K. Wolf E.Wong K.Yao

With 58 Illustrations

A Dowden & Culver Book



Springer-Verlag
New York Berlin Heidelberg Tokyo

Ian F. Blake
Department of Electrical Engineering
University of Waterloo
Waterloo, Ontario N2L 3G1
Canada

H. Vincent Poor
Department of Electrical
and Computer Engineering
University of Illinois at Urbana-
Champaign
Urbana, IL 61801
U.S.A.

Library of Congress Cataloging-in-Publication Data

Main entry under title:

Communications and networks.

Bibliography: p.

Includes index.

1. Signal theory (Telecommunication)—Addresses, essays, lectures. 2. Coding theory—Addresses, essays, lectures. 3. Estimation theory—Addresses, essays, lectures. I. Blake, Ian F. II. Poor, H. Vincent.

TK5102.5.C617 1986 001.64'4 85-4667

© 1986 by Springer-Verlag New York Inc.

Softcover reprint of the hardcover 1st edition 1986

All rights reserved. No part of this book may be translated or reproduced in any form without written permission from Springer-Verlag, 175 Fifth Avenue, New York, New York 10010, U.S.A.

Printed and bound by R.R. Donnelley & Sons, Harrisonburg, Virginia.

Printed in the United States of America.

9 8 7 6 5 4 3 2 1

ISBN-13: 978-1-4612-9354-5

e-ISBN-13: 978-1-4612-4904-7

DOI: 10.1007/978-1-4612-4904-7

In appreciation of John B. Thomas
on the occasion of his sixtieth birthday and his thirtieth
year of teaching at Princeton University.

CONTENTS

LIST OF CONTRIBUTORS	ix
INTRODUCTION	1
PART I SIGNAL DETECTION, ESTIMATION, AND RANDOM PROCESSES	5
1. A Survey of Recent Progress on Level-Crossing Problems for Random Processes	6
JULIA ABRAHAMS	
2. On Detection-Estimation Schemes for Uncertain Systems	26
A.H. HADDAD	
3. Series Expansions in Statistical Theory of Detection and Estimation	47
Y.F. HUANG	
4. Optimum Data Quantization in Signal Detection	72
SALEEM A. KASSAM	
5. Digital Parameter Estimation	111
C.C. LEE	
6. Robustness in Signal Detection	131
H. VINCENT POOR	
7. Sequential Detection of a Positive Signal	157
SAWASD TANTARATANA	
8. Recent Developments in Nonlinear Time-Series Modeling	197
DAG TJØSTHEIM	
9. In Search of Multiparameter Markov Processes	230
EUGENE WONG	

PART II CODING, NETWORKS AND SIGNAL PROCESSING	245
10. Coding for Interference Channels IAN F. BLAKE	246
11. The Use of Gibbs Distributions in Image Processing HALUK DERIN	266
12. The Routing Problem in Computer Networks ANTHONY EPHREMIDES	299
13. Theoretical Analysis of Slotted ALOHA, CSMA and CSMA-CD Protocols YIH-CHYUN JENQ	325
14. Image Compression via Self-Error-Correcting Two-Dimensional Coding MORTON E. KANEFSKY	347
15. Vector Quantization PETER F. SWASZEK	362
16. The Chinese Remainder Theorem and Applications JACK KEIL WOLF	390
17. Detection of Complex Sinusoids by the Pisarenko Method KUNG YAO	406
INDEX	429

LIST OF CONTRIBUTORS

JULIA ABRAHAMS

Department of Electrical and Computer Engineering, Carnegie-Mellon
University, Pittsburgh, Pennsylvania

IAN F. BLAKE

Department of Electrical Engineering, University of Waterloo,
Waterloo, Ontario, Canada

HALUK DERIN

Department of Electrical and Computer Engineering, University of
Massachusetts, Amherst, Massachusetts

ANTHONY EPHREMIDES

Department of Electrical Engineering, University of Maryland,
College Park, Maryland

A.H. HADDAD

School of Electrical Engineering, Georgia Institute of Technology,
Atlanta, Georgia

Y.F. HUANG

Department of Electrical Engineering, University of Notre Dame, Notre
Dame, Indiana

YIH-CHYUN JENQ

Tektronix Research Laboratories, Beaverton, Oregon

MORTON E. KANEFSKY

Department of Electrical Engineering, University of Pittsburgh,
Pittsburgh, Pennsylvania

SALEEM A. KASSAM

Moore School of Electrical Engineering, University of Pennsylvania,
Philadelphia, Pennsylvania

C.C. LEE

Department of Electrical Engineering and Computer Science, Northwestern
University, Evanston, Illinois

H. VINCENT POOR

Department of Electrical and Computer Engineering, University of Illinois
at Urbana-Champaign, Urbana, Illinois

PETER F. SWASZEK

Department of Electrical Engineering, University of Rhode Island,
Kingston, Rhode Island

SAWASD TANTARATANA

AT&T Bell Laboratories, Holmdel, New Jersey

DAG TJØSTHEIM

Department of Mathematics, University of Bergen, Bergen, Norway

JACK KEIL WOLF

Department of Electrical Engineering and Computer Sciences, University of
California at San Diego, La Jolla, California

EUGENE WONG

Department of Electrical Engineering and Computer Sciences, University of
California at Berkeley, Berkeley, California

KUNG YAO

Department of System Science, University of California at Los Angeles,
Los Angeles, California