

**MULTIACCESS, MOBILITY AND TELETRAFFIC
FOR PERSONAL COMMUNICATIONS**

**THE KLUWER INTERNATIONAL SERIES
IN ENGINEERING AND COMPUTER SCIENCE**

COMMUNICATIONS AND INFORMATION THEORY

Consulting Editor

Robert Gallager

Other books in the series:

- PERSONAL AND WIRELESS COMMUNICATIONS: *Digital Technology and Standards***, Kun Il Park
ISBN: 0-7923-9727-4
- WIRELESS INFORMATION NETWORKS: *Architecture, Resource Management, and Mobile Data***, Jack M. Holtzman
ISBN: 0-7923-9694-4
- DIGITAL IMAGE COMPRESSION: *Algorithms and Standards***, Weidong Kou
ISBN: 0-7923-9626-X
- CONTROL AND PERFORMANCE IN PACKET, CIRCUIT, AND ATM NETWORKS**, XueDao Gu, Kazem Sohrawy and Dhadesugoor R. Vaman
ISBN: 0-7923-9625-1
- DISCRETE STOCHASTIC PROCESSES**, Robert G. Gallager
ISBN: 0-7923-9583-2
- WIRELESS PERSONAL COMMUNICATIONS: *Research Developments***, Brian D. Woerner, Theodore S. Rappaport and Jeffrey H. Reed
ISBN: 0-7923-9555-7
- PLANNING AND ARCHITECTURAL DESIGN OF INTEGRATED SERVICES DIGITAL NETWORKS**, A. Nejat Ince, Dag Wilhelmsen and Bülent Sankur
ISBN: 0-7923-9554-9
- WIRELESS INFRARED COMMUNICATIONS**, John R. Barry
ISBN: 0-7923-9476-3
- COMMUNICATIONS AND CRYPTOGRAPHY: *Two sides of One Tapestry***, Richard E. Blahut, Daniel J. Costello, Jr., Ueli Maurer and Thomas Mittelholzer
ISBN: 0-7923-9469-0
- WIRELESS AND MOBILE COMMUNICATIONS**, Jack M. Holtzman and David J. Goodman
ISBN: 0-7923-9464-X
- INTRODUCTION TO CONVOLUTIONAL CODES WITH APPLICATIONS**, Ajay Dholakia
ISBN: 0-7923-9467-4
- CODED-MODULATION TECHNIQUES FOR FADING CHANNELS**, S. Hamidreza Jamali, and Tho Le-Ngoc
ISBN: 0-7923-9421-6
- WIRELESS PERSONAL COMMUNICATIONS: *Trends and Challenges***, Theodore S. Rappaport, Brian D. Woerner, Jeffrey H. Reed
ISBN: 0-7923-9430-5
- ELLIPTIC CURVE PUBLIC KEY CRYPTOSYSTEMS**, Alfred Menezes
ISBN: 0-7923-9368-6
- SATELLITE COMMUNICATIONS: *Mobile and Fixed Services***, Michael Miller, Branka Vucetic and Les Berry
ISBN: 0-7923-9333-3
- WIRELESS COMMUNICATIONS: *Future Directions***, Jack M. Holtzman and David J. Goodman
ISBN: 0-7923-9316-3
- DISCRETE-TIME MODELS FOR COMMUNICATION SYSTEMS INCLUDING ATM**, Herwig Bruneel and Byung G. Kim
ISBN: 0-7923-9292-2
- APPLICATIONS OF FINITE FIELDS**, Alfred J. Menezes, Ian F. Blake, XuHong Gao, Ronald C. Mullin, Scott A. Vanstone, Tomik Yaghoobian
ISBN: 0-7923-9282-5
- WIRELESS PERSONAL COMMUNICATIONS**, Martin J. Feuerstein, Theodore S. Rappaport
ISBN: 0-7923-9280-9
- SEQUENCE DETECTION FOR HIGH-DENSITY STORAGE CHANNEL**, Jaekyun Moon, L. Richard Carley
ISBN: 0-7923-9264-7
- DIGITAL SATELLITE COMMUNICATIONS SYSTEMS AND TECHNOLOGIES: *Military and Civil Applications***, A. Nejat Ince
ISBN: 0-7923-9254-X
- IMAGE AND TEXT COMPRESSION**, James A. Storer
ISBN: 0-7923-9243-4
- VECTOR QUANTIZATION AND SIGNAL COMPRESSION**, Allen Gersho, Robert M. Gray
ISBN: 0-7923-9181-0

MULTIACCESS, MOBILITY AND TELETRAFFIC FOR PERSONAL COMMUNICATIONS

EDITED BY

Bijan Jabbari

*George Mason University
Fairfax, VA, US*

Philippe Godlewski

*Ecole Nationale Supérieure des Télécommunications
Paris, France*

Xavier Lagrange

*Ecole Nationale Supérieure des Télécommunications
Paris, France*



KLUWER ACADEMIC PUBLISHERS

BOSTON / DORDRECHT / LONDON

A C.I.P. Catalogue record for this book is available from the Library of Congress

ISBN-13: 978-1-4612-8611-0
DOI: 10.1007/978-1-4613-1409-7

e-ISBN-13: 978-1-4613-1409-7

**Published by Kluwer Academic Publishers,
P.O. Box 17, 3300 AA Dordrecht, The Netherlands.**

**Kluwer Academic Publishers incorporates
the publishing programmes of
D. Reidel, Martinus Nijhoff, Dr W. Junk and MTP Press.**

**Sold and distributed in the U.S.A. and Canada
by Kluwer Academic Publishers,
101 Philip Drive, Norwell, MA 02061, U.S.A.**

**In all other countries, sold and distributed
by Kluwer Academic Publishers Group,
P.O. Box 322, 3300 AH Dordrecht, The Netherlands.**

Printed on acid-free paper

All Rights Reserved

© 1996 Kluwer Academic Publishers, Boston

Softcover reprint of the hardcover 1st edition 1996

**No part of the material protected by this copyright notice may be reproduced or
utilized in any form or by any means, electronic or mechanical,
including photocopying, recording or by any information storage and
retrieval system, without written permission from the copyright owner.**

Table of Contents

Preface.....	vii
Distributed Discrete Power Control in Cellular PCS	
M. Andersin, J. Zander, Z. Rosberg.....	1
Congestion measures and capacity constraints in spread spectrum networks	
S. Hanly.....	15
Channel Control and Multiple-Access	
R. Knopp, P.A. Humblet.....	29
On the Effect of Chip Synchronization Error in MC-CDMA Systems	
L. Tomba, W.A. Krzymien.....	43
Coded Modulations and Diversity for Satellite Cellular Communications	
E. Biglieri, G. Caire, G. Taricco, J. Ventura-Traveset.....	57
Multicode High-Speed Transmission with Interference Cancellation for Wireless Personal Communications	
M. Chan, J. C-I Chuang.....	73
Packet Access For Cellular Systems: The Capacity of S-Aloha and CDPA with Slow Varying Shadowing	
M. Zorzi, F. Borgonovo, L. Fratta.....	87
Dynamic Slot Allocation for TDMA-Systems with Packet Access	
T. Benkner.....	103
Design and Evaluation of an RRA Scheme for Voice-Data Channel Access in Outdoor Microcellular Wireless Environments	
A. Cleary, M. Paterakis.....	117
Design and Evaluation of Paging Strategies for Personal Communications	
D. Goodman, P. Krishnan, B. Sugla.....	131
Database Architectures and Location Strategies for Mobility Management in Mobile Radio Systems	
N. Tabbane, S. Tabbane.....	145
Infinite Server Traffic Models for CDMA Cellular Mobile Networks	
J. Evans, D. Everitt.....	157
Modeling Priority Traffic and Hot Spots in Wireless PCS Systems	
M.L. Merani.....	171

A Satellite-Augmented Cellular Network Concept D. Ayyagari, A. Ephremides	185
Recent Developments of Adaptive Air Interfaces K. David	199
Feasibility Study for a GSM Private Cordless Base Station Based on Total Frequency Hopping M. Kuusela, M.I. Silventoinen, M. Raitola	211
On Satellite Path Diversity for GSM Rate Compatible TDMA Big LEOs T.E. Wisloff	225
An Optimal Channel Allocation Algorithm in a Linear Cellular Reuse Partitioning Network P.P. Bhattacharya, L. Tassiulas.....	241
The Delta-adjusted Mth Order Multiuser Detector L.L. Yang, R.A. Scholtz.....	249
Non-coherent diversity receivers for mobile and personal satellite communications D. Markrakis, D.P. Bouras, P.T. Mathiopoulos	265
Interference Adaptive Multiple Access in a Multi Access Port Radio System C. Roobol	279
Time-Frequency Slicing with Distributed-Queueing Request Update Multiple Access for Multi-Rate Wireless Packet (ATM) Networks Z. Liu, M.J. Karol, K.Y. Eng, M.E. Zarki.....	293
Routing in an ATM-Based Mobile Network I. Katzela, M. Veeraraghaven	307
Optimization of Capture in Multiple Access Radio Systems with Rayleigh Fading and Random Power Levels R.O. LaMaire, A. Krishna, M. Zorzi.....	321
A New medium Access Control Protocol for Integrated Traffic Personal Communication Networks D. Markrakis, R.S. Mander, L. Orozco-Barbosa, P. Papantoni-Kazakos.....	337
A Call-Level Access Control Strategy for Integrated Services Wireless Packet Networks F. Davoli, P. Maryni, C. Nobile	351

Preface

The success of first and second generation wireless systems has paved the way for further research opportunities towards the next generation systems. The two standards GSM and IS-95 based on TDMA and CDMA respectively, have deeply influenced our system-level understanding, bringing new perspectives on the problems associated with wireless networks and potential for innovations.

This volume presents the proceedings of the second workshop on multiaccess, mobility and teletraffic for personal communications held in May 1996 in Paris, France where some important subjects on the next generation systems have been treated. These include topics dealing with information theoretic aspects, channel modeling, diversity, interference control, resource allocation, power control, packet multi-access, stochastic modeling of mobility and traffic, and wireless network control.

The selected topics in this workshop and their presented set of solutions reflect the richness of the problems in wireless communications. Indeed, development of theoretical frameworks with considerable attention to the peculiar environment of wireless communications has been the prime objective of this workshop. To elaborate, consider the problem of multi-access methods which remains a challenge for researchers. A complete evaluation of an access scheme must consider different aspects such as propagation, interference, mobility and traffic modeling. Some common bases, paradigms and models are needed. For example, today, we do not have a common archetype like the AWGN channel as in classical statistical communication. Clearly, there is a need for justified assumptions and models. Some progress, however, can be noticed. Similarly, such a framework can be also useful in evaluating the effect of mobility and system capacity.

The next generation wireless systems as well as the evolved second generation systems will certainly benefit from these useful results. As in the past, we can gain experience from the existing implemented systems and develop novel features for the next generation systems. Indeed, it is not surprising to observe some common features in the second generation systems, not specifically present in the first generation systems. One example is channel encoding done in the framework of GSM and IS95 systems, though maybe viewed in different scales, to mitigate various interference and propagation effects through interleaving, equalization, spreading or hopping, synchronization and channel sounding. Other examples include the enhanced handover techniques and location management being deployed in these systems.

There is no doubt that further work is still needed in these areas, in particular in microcellular and picocellular environment. We have already witnessed wide-spread and successful use of microcells in the second generation mobile cellular systems and we are awaiting possible system implementation by public cordless system. The third generation systems may have to address the optimal way to achieve a goal of 10,000

Erlang/km². This is to be considered in a heterogeneous traffic environment necessitating the need for a highly adaptive system with different access modes incorporating sophisticated resource allocation algorithms and various control procedures within the wireless channel and the network. Furthermore, they will have to provide user mobility in a larger scale. Certainly giving rise to interesting problems in mobility control and the signaling traffic.

We hope this workshop has made a small contribution to the field and further stimulated the ideas for research.

Bijan Jabbari

Philippe Godlewski

Xavier Lagrange

Acknowledgment

We wish to extend our gratitude to the following people who helped us in the review of the papers.

A. Baiocchi
K. Basu
T. Benkner
V. Brass
J. Chuang
G. Colombo
L. Decreusefond
K. Demetrios
C. Despins
U. Dropmann
J. Dunlop
D. Everitt
W. Fuhrmann
M. Gagnaire
B. Goode
P. Humblet
A. Jalali
H. Jiang
G. Kawas-Kaleh
V. Kumar

A. Levy
J-P. Linnartz
G. Maral
D. McMillan
G. Omidyar
K. Pahlavan
R. Pickholtz
R. Rom
C. Rose
M. Rumsewicz
H. Sari
S. Tabbane
G. Taricco
R. Vallet
B. Vojcic
P. Wirth
M. Yabusaki
P. Yegani
G. Zemor