

COMPUTERS' IN CARDIOLOGY

**October 4-7, 1983
Aachen, Germany**

**10th Annual
Meeting**

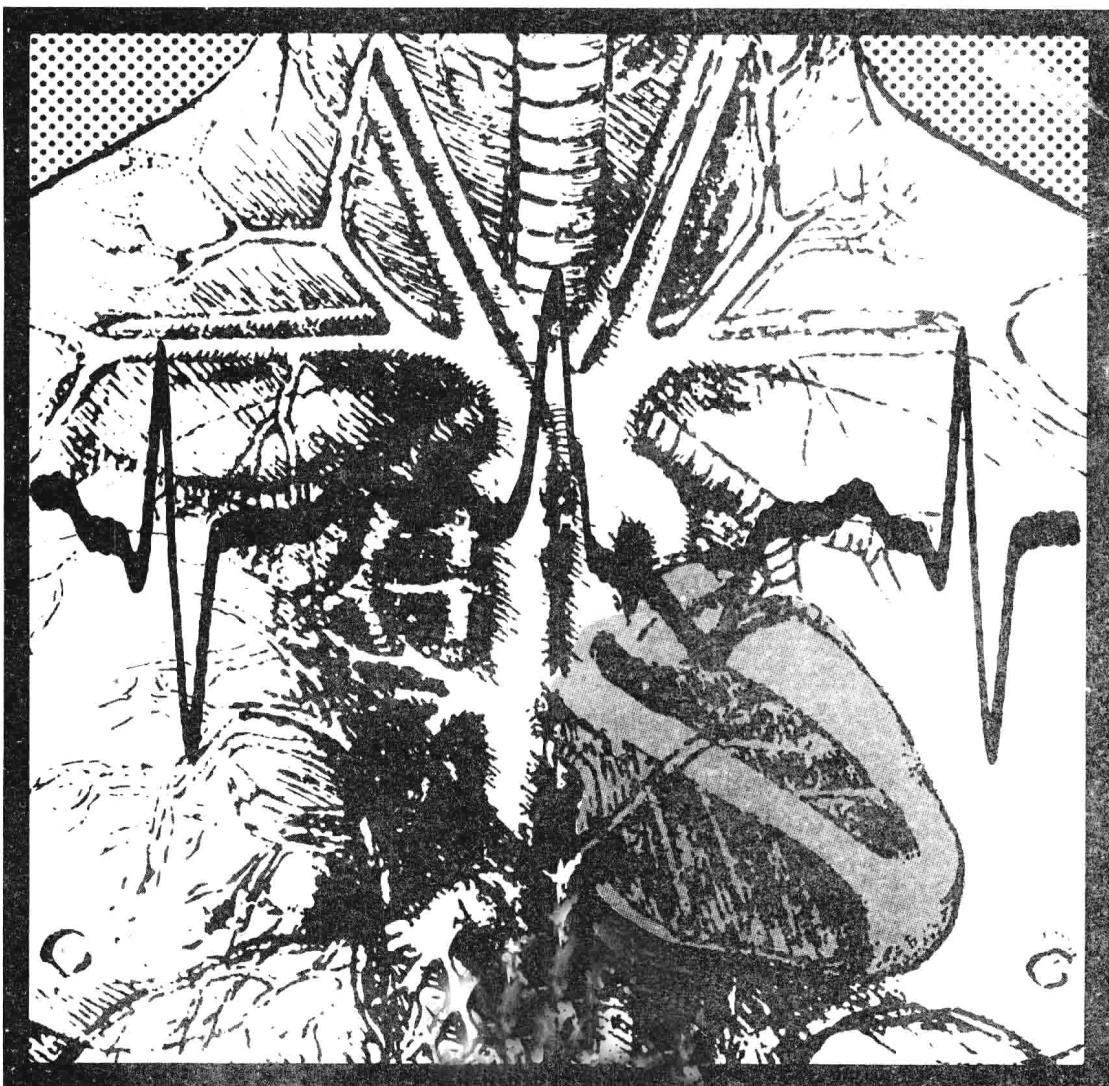
ISSN NO. 0276-6574

IEEE CATALOG NO. 83CH1927-3

LIBRARY OF CONGRESS NO. 80-641097

IEEE COMPUTER SOCIETY ORDER NO. 496

ISBN NO. 0-8186-0496-4



The papers appearing in this book comprise the proceedings of the meeting mentioned on the cover and title page. They reflect the authors' opinions and are published as presented and without change, in the interests of timely dissemination. Their inclusion in this publication does not necessarily constitute endorsement by the editors, IEEE Computer Society Press, or the Institute of Electrical and Electronics Engineers, Inc.

Computers in cardiology / National Institutes of Health ... [et al.]

— Oct. 2-4, 1974 — Long Beach, Calif. : IEEE Computer Society, c1974-

v. : ill. ; 29 cm.

Annual.

ISSN 0276-6574 = Computers in cardiology.

1. Cardiology—Data processing—Congresses. 2. Patient monitoring—Data processing—Congresses. I. National Institutes of Health (U.S.) II. IEEE Computer Society.

RC683.3.D36C637

616.1'2'02854

80-641097

AACR 2 MARC-S

Library of Congress

t8111

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limits of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 21 Congress Street, Salem, MA 01970. Instructors are permitted to photocopy isolated articles for noncommercial classroom use without fee. For other copying, reprint or republication permission, write to Director, Publishing Services, IEEE, 345 E. 47 St., New York, NY 10017. All rights reserved. Copyright © 1983 by The Institute of Electrical and Electronics Engineers, Inc.

ISSN 0276-6574

ISBN 0-8186-0496-4 (paper)

ISBN 0-8186-4496-6 (microfiche)

ISBN 0-8186-8496-8 (casebound)

IEEE Catalog Number 83CH1927-3

Library of Congress Number 80-641097

IEEE Computer Society Order Number 496

Order from: IEEE Computer Society
Post Office Box 80452
Worldway Postal Center
Los Angeles, CA 90080

IEEE Service Center
445 Hoes Lane
Piscataway, NJ 08854



The Institute of Electrical and Electronics Engineers, Inc.

CO-SPONSORS

IEEE Computer Society

National Institutes of Health

Division of Computer Research and Technology

National Heart, Lung and Blood Institute

European Society of Cardiology

Deutsche Gesellschaft fur Herz-und Kreislaufforschung

ORGANIZING COMMITTEE

Chairmen

Jerome R. Cox, Jr. ScD

Department of Computer Science

Washington University

St. Louis, Missouri 63130, USA

Paul G. Hugenholtz, MD

Thoraxcentrum

Erasmus University

Rotterdam, The Netherlands

Treasurers

Harold G. Ostrow, MS

Division of Computer Research

and Technology

National Institutes of Health

Bethesda, Maryland 20205, USA

Carlo Marchesi, PhD

Istituto di Fisiologia Clinica

de CNR

Universita di Pisa

56100 Pisa, Italy

Secretaries

William J. Sanders

Cardiology Division

Stanford University

Palo Alto, California 94305, USA

Cees Zeelenberg, MS

Thoraxcentrum

Erasmus University

Rotterdam, The Netherlands

Publications Chairman

Harry Hayman

IEEE Computer Society

Silver Spring, Maryland 20901, USA

Proceedings Editor

Kenneth L. Ripley, MS

Thoraxcentrum

Erasmus University

Rotterdam, The Netherlands

LOCAL COMMITTEE

Jurgen Meyer, MD

11. Medical Clinic

Johannes Gutenberg University

D-6500 Mainz, Germany

Sven Effert, MD

Rainer v. Essen, MD

Department Internal Medical 1

RWTH

D-5100 Aachen, Germany

Gunter Rau, PhD

Jiri Silny, PhD

Helmholtz-Institute

RWTH

D-5100 Aachen, Germany

CONFERENCE STAFF

Gerda Marie Stöhr

Mary N. Ripley

INTRODUCTION

The tenth meeting of Computers in Cardiology takes place this year in Aachen, one of the oldest German cities. Of historical repute — Charlemagne had his residence here for almost 20 years and is buried in the famous cathedral — this city now also boasts of one of the most modern University Hospitals in Germany and one of the leading technical schools. This is a wonderful backdrop for our second lustrum, the tenth meeting of Computers in Cardiology!

The conference is preceded by a day of now well accepted and much appreciated tutorials. These provide the opportunity to learn about new developments in a relatively limited field in close contact with a leading expert. It also serves for those who wish to enter into a new field and the emphasis is on personal exchange of opinions.

The first plenary session on Wednesday shows that, although the topics that have been themes in Computers in Cardiology in the past ten years have gradually changed, there is also a healthy rotation of attention. This is the reason why the opening session this year is devoted to echocardiography. In the remaining two days the main themes are wall motion and arrhythmia analysis.

The conference continues to provide a forum available *equally* to physicians, engineers and computer scientists for the timely exchange of scientific information on design and application of computer know-how to the field of cardiology.

The goal of Computers in Cardiology for sharing research results seems to continue to be well served by the present meeting format. The technical program this year is again a clear testimony to the steady increase in quality of the work done in our field. The question posed last year, whether there is a role for Computers in Cardiology to play in the training of young cardiologists, has been answered in part: the American College of Cardiology has accepted a joint effort with CIC led by Dr. Cox's team for such a course in Bethesda.

There is little doubt that a similar effort on personal computing should follow in Europe now. As computers touch an increasing number of facets of cardiology, the technical information needed to utilize these tools effectively must be taught in a more systematic manner than is the case today. The role that some of our membership can play in moving toward this goal may be a substantial one.

We all wish you a good and refreshing stay in Aachen, where history seems to have come full cycle:

Think of what Charlemagne could have done with an Apple!

**Jerome R. Cox, Sc. D.,
Paul G. Hugenholtz, M.D.
Chairmen
COMPUTERS IN CARDIOLOGY**

1983 Computers in Cardiology Conference
Aachen, West Germany

TABLE OF CONTENTS

PLENARY SESSION 1 ECHOCARDIOGRAPHY	1
<u>N. Bom and J. Meyer - Co-Chairmen</u>	
DEVELOPMENT AND IMPLEMENTATION OF A MINICOMPUTER ECHOCARDIOGRAPHIC DATABASE FOR CLINICAL TEACHING AND RESEARCH APPLICATION L.E. Ginzton, W.R. Lym and M.M. Laks	3
A COMPUTER AIDED SYSTEM FOR BOTH ROUTINE AND SPECIALIZED GEOMETRIC EVALUATION OF 2D-ECHOCARDIOGRAMS D.G.W. Onnasch, A. Wessel, P.E. Lange, M.P. Heintzen and P.H. Heintzen	9
COMPUTER VIDEODENSITOMETRY OF TWO-DIMENSIONAL CONTRAST ECHOCARDIOGRAMS K.W. Ong, G. Maurer, W. Zwehl, S. Meerbaum and E. Corday	15
MYOCARDIAL INFARCT SIZE DETERMINED BY 2-DIMENSIONAL ECHOCARDIOGRAPHY L.T. Andrews, R.D. Wilkerson, A.D. Nelson, J.A. Arthur, J.W. Klingler and T.D. Fraker, Jr.	21
PATTERN ANALYSIS APPROACHES TO ULTRASOUND TISSUE CHARACTERIZATION USING AN IMAGE SEQUENCE PROCESSING SYSTEM P. Jensch, W. Kubalski, A. de A. Araujo, W. Ameling, R.v. Essen, H. Lambertz and S. Effert	27
PLENARY SESSION 2 WALL MOTION	33
<u>S. Effert and W. Ameling - Co-Chairmen</u>	
MEASUREMENT OF ABNORMALITIES IN THE TIMING AND EXTENT OF MOTION FROM FRAME-BY-FRAME ANALYSIS OF CONTRAST LEFT VENTRICULOGRAMS F.H. Sheehan, H.T. Dodge, D.G. Mathey, A. Szente, H.-W. Woo and E.L. Bolson	35
INTEREST OF LOCAL MYOCARDIAL STRESS IN SEGMENTAL WALL MOTION ANALYSIS C. van Eyll, H. Pouleur, M.F. Rousseau, L.A. Brasseur, J.M. Detry and A.A. Charlier	41
MEASUREMENT OF LEFT VENTRICULAR SHAPE DISTORTION B.I. Jugdutt, R.L. Cahn, C.A. Basualdo and R.E. Rossall	47
NEW METHOD FOR RIGHT VENTRICULAR VOLUME DETERMINATION BY TWO-DIMENSIONAL ECHOCARDIOGRAPHY R. Erbel, W. Krebs, I. Massberg, P. Schweizer, H.A. Richter, J. Meyer and S. Effert	53
MINICOMPUTER-BASED QUANTITATIVE SEGMENTAL WALL MOTION DURING MAXIMAL DYNAMIC EXERCISE: VARIABILITY AND HETEROGENEITY IN NORMAL ADULTS L.E. Ginzton, R. Conant, M. Brizendine, T. Thigpen and M.M. Laks	57
RECONSTRUCTION OF THE LEFT VENTRICLE FROM X-RAY CINEANGIOPHOTOGRAMS WITH A ROTATING ARM S. Eiho, M. Kuwahara, K. Shimura, M. Wada, M. Ohta and T. Kozuka	63

PLENARY SESSION 3 ARRHYTHMIA ANALYSIS	69
<u>L.J. Thomas, Jr. and G. Rau - Co-Chairmen</u>	
HOW CAN WE PREDICT REAL-WORLD PERFORMANCE OF AN ARRHYTHMIA DETECTOR?	71
G.B. Moody and R.G. Mark	
APPLICATION OF PATTERN RECOGNITION TECHNIQUES TO QRS COMPLEX CLASSIFICATION--A REVIEW	77
J.Y.J. Wang	
A PORTABLE ARRHYTHMIA MONITOR FOR AMBULATORY USE	83
L. Patomaki and E. Lansimies	
AUTOMATED ANALYSIS OF ST SEGMENT CHANGES IN AMBULATORY ECG RECORDINGS	89
M.-E. Nygards, I. Ringqvist, T. Ahren, K. Johansson, T. Jonason, L. Lundin, G. Nilsson and A. Walker	
AUTOMATED RECOGNITION OF TACHYCARDIAS FROM ELECTROGRAMS: DECISION RULES FOR DIAGNOSIS	93
J. Jenkins, T. Bump, K. Glick, R. Arzbaecher, J. Brown and N. Nandhakumar	
ANALYSIS OF AMBULATORY ECGS FOR PATIENTS WITH DUAL CHAMBER PACEMAKERS	97
C.L. Feldman and M. Hubelbank	
 SESSION 1	
ECHOCARDIOGRAPHY	103
<u>L.E. Ginzton - Chairman</u>	
A MICROCOMPUTERIZED ON-LINE IMAGE PROCESSING SYSTEM FOR SECTOR SCAN ECHOCARDIOGRAPHY	105
M. Kuwahara, S. Eiho, H. Kitagawa, N. Asada, K. Ohtsuyama and H. Ogawa	
OPTIMIZED IDENTIFICATION OF THE LEFT VENTRICULAR WALL MOTION BY ECHOCARDIOGRAPHY: A REEVALUATION OF THE M-MODE TECHNIQUE	109
G. Pelle, P. Vignon, J. Malak, C. Oddou and P. Brun	
IMAGE TEXTURE IN TWO DIMENSIONAL ECHOCARDIOGRAPHY	113
S.M. Collins, D.J. Skorton, N.V. Prasad, B.O. Olshansky and J.A. Bean	
CONTROLLED IMAGE ACQUISITION, SEGMENTATION, FEATURE EXTRACTION AND CLASSIFICATION OF ECHOCARDIOGRAPHIC SECTOR SCANS	117
W. Siler, T. Cooper, J. Arciniegas, W. MacLean, S. Papapietro, R. Hess, A. Stanley, V. Powell, M. McEachern, P. Jolly, R. Morrison, J. Buckley and S. Waldrop	

SESSION 2	<u>DATABASE</u>	121
	J.R. Cox, Jr. - Chairman	
	A DATABASE SYSTEM FOR RESEARCH IN CLINICAL CARDIOLOGY: DEVELOPMENT RETROSPECTION AND APPLICATION	123
	P.J. Jasinski, H. Krug and M. Szymanska	
	USE OF A CORONARY CARE INFORMATION SYSTEM FOR THE ASSESSMENT OF PROGNOSIS IN ACUTE MYOCARDIAL INFARCTION	127
	J. Pardaens, J.L. Willems and H. De Geest	
	DATA BASE IN ACUTE CORONARY DISEASE: VALIDATION OF THERAPEUTIC DECISIONS BASED ON COMPUTERIZED MONITORING AND HEMODYNAMIC EVALUATIONS	131
	J. Col, J.L. Bachy, Ch. Doyen, M.F. Hennekin, M. Pierart and L. Lambotte	
	THE AUTOMATIC GENERATION OF DISCHARGE LETTERS IN THE CORONARY CARE UNIT	135
	R.T. van Domburg and M.L. Simoons	
	AN ON-LINE DATA BASE MANAGEMENT SYSTEM FOR A CLINICAL CARDIOLOGY RESEARCH VISIT	139
	A.D. Goldberg, M. Helpern, T.G. Lee, B. Wojtaszak and S. Goldstein	
SESSION 3	<u>ECG INTERPRETATION</u>	141
	R.T. Degani - Chairman	
	A COMPUTER PROGRAM FOR THE ANALYSIS OF SERIAL ELECTROCARDIOGRAMS FROM PATIENTS WHO SUFFERED A MYOCARDIAL INFARCTION	143
	A.C.T.A. van Haelst, D.K. Donker, F.C. Visser, C.C. de Cock, A. Hasman and J.L. Talmon	
	PROGNOSTIC VALUE OF QUANTITATIVE ECG ANALYSIS	147
	J. Michaelis, R. Lippold, E. Gluck, E. Scheidt and W. Schindler	
	A VCG/ECG DATABASE CONSISTING IN 30-MINUTES-LONG, X Y AND Z TRACINGS FROM 30 YOUNG NORMAL SUBJECTS	151
	R. Botttoni, M. Misiano and F. Pinciroli	
	COMPUTER INTERPRETATION OF PEDIATRIC VECTORCARDIOGRAMS BY MULTIVARIATE STATISTICAL CLASSIFICATION TECHNIQUES	155
	A. Robert, Ch. Derwael-Barchy, R. Fesler, M. Stijns, A. Vliers, L.A. Brasseur and Ch.R. Brohet	
	EIGHT YEARS EXPERIENCE IN DEVELOPMENT OF A PEDIATRIC COMPUTERIZED ECG PROGRAM	159
	M.M. Laks	

SESSION 4	<u>WALL MOTION</u>	163
	R. Erbel and E. Wood - Co-Chairmen	
	IN VIVO DETERMINATION OF ENDDIASTOLIC AND ENDSYSTOLIC CORRECTION FACTORS FOR LEFT AND RIGHT VENTRICULAR VOLUMES - A NEW STATISTICAL METHOD	165
	P. Chatelain, M. Fleisch, P.-A. Doriot, L. Rasoamanambelo and W. Rutishauser	
	A MATHEMATICAL BASIS FOR THE QUANTITATIVE COMPARISON OF CARDIAC BORDERS: CRITERIA FOR SELECTION OF DESCRIPTORS AND AN ANALYSIS OF TWO METHODS	169
	D.T. Linker and A.S. Pearlman	
	EFFECTS OF CORRECTING APICAL DISPLACEMENT ON REGIONAL WALL MOTION IN SEVERELY DAMAGED VENTRICLES	173
	R.F. Leighton, G. Drobinski, G.H. Fontaine, M. Eugene, R. Frank and Y. Grosgeat	
	COMPUTER-AIDED QUANTIFICATION OF SEGMENTAL WALL MOTILITY AFTER MYOCARDIAL INFARCTION	177
	G. Biamino, Th. Bruggemann, Th. Linderer and R. Schroder	
	CT EVALUATION OF LEFT VENTRICULAR MYOCARDIAL VOLUME	181
	K.J. Klose, C. Duber, M. Thelen, T. Meinertz, W. Kasper and R. Erbel	
SESSION 5	<u>ARRHYTHMIA PROCESSING SYSTEMS</u>	183
	R.G. Mark - Chairman	
	THE MICRO CPR: AN AUTOMATED TWO LEAD AMBULATORY ECG ANALYSIS SYSTEM	185
	I.M. Stein, P. Hoffman, C. Sloan, D.R. Doxtader and C.C. Day	
	THE HIGH-SPEED SINGLE-SCAN ANALYSIS OF HOLTER ELECTROCARDIOGRAMS WITH A MICROPROCESSOR	189
	P.J. Bones, D.R. Mackay, R.B. Raymond and H. Ikram	
	AN ANNOTATED DATA BASE FOR THE EVALUATION OF ALGORITHMS FOR THE ANALYSIS OF ARRHYTHMIAS AND ISCHEMIC EVENTS	191
	A. Taddei, M. Varanini, A. Macerata, C. Marchesi, C. Contini, A. Biagini, M.G. Bongiorni, M.G. Mazzei, G.F. Mazzocca and M. Baratto	

SESSION 6	<u>ELECTROPHYSIOLOGICAL MODELS</u>	195
	J. Willems - Chairman	
	EXPERIMENTAL APPLICATION OF A COMPUTER MODEL FOR ATRIAL FIBRILLATION	197
	R.D. Berger, M.T. Bailin, F. Pollick and R.J. Cohen	
	SIMPLE COMPUTER MODEL OF CARDIAC CONDUCTION DISTURBANCES	201
	J.M. Smith, A.L. Ritzenberg and R.J. Cohen	
	COMPUTERIZED ANALYSIS FOR AN EXPERIMENTAL VALIDATION OF NEUROPHYSIOLOGICAL MODELS OF HEART RATE CONTROL	205
	M. Brovelli, G. Baselli, S. Cerutti, S. Guzzetti, D. Liberati, F. Lombardi, A. Malliani, M. Pagani and P. Pizzinelli	
	FAST FOURIER TRANSFORMATION FOR THE QUANTIFICATION OF PREEXCITATION IN WOLFF-PARKINSON-WHITE SYNDROME	209
	G.S. Butrous, T. Cochrane, J. O'Keefe, A.W. Nathan and A.J. Camm	
	EFFECTS OF CALCIUM ANTAGONISTS ON TIME COURSE OF ECG POWER SPECTRUM DURING VENTRICULAR FIBRILLATION	213
	G. Martin, J.V. Gimeno, I. Guillen and J. Cosin	
	ARRHYTHMIA SIMULATION AND EXPLICATION BY COMPUTER MODELLING OF CARDIAC CONDUCTION	217
	G.T. Hagen, W.R.M. Dassen, T.E. Bump and R.C. Arzbaecher	
SESSION 7	<u>ARRHYTHMIA MONITORING TECHNIQUES</u>	221
	K.L. Ripley - Chairman	
	OPTIMIZATION OF AN ARRHYTHMIA CLASSIFICATION DECISION RULE BASED ON A FIXED PARAMETER SET OVER AN AUGMENTED MIT-BIH ARRHYTHMIA DATABASE	223
	A.T. Moser and T.D. Pierce	
	A NEW METHOD FOR DETECTING ATRIAL FIBRILLATION USING R-R INTERVALS	227
	G.B. Moody and R.G. Mark	
	ALGORITHMS FOR THE INTERPRETATION OF VENTRICULAR ARRHYTHMIAS	231
	C.A. Swenne and N.M. van Hemel	
	PRELIMINARY RESULTS FROM CROSS-CORRELATION BEAT SORTING AND ANALYSIS FOR ARRHYTHMIA MONITORING	235
	F. Johnson	
	ECG WAVEFORM CHARACTERIZATION BY DISCRETE COSINE TRANSFORM	239
	V.K. Murthy, J. Propst, R. Huss and L.J. Haywood	
	PERSISTENCY OF THE DIRECTION OF SOME VIRTUAL LEADS EXPERIMENTED ON THE BIH/MIT ARRHYTHMIA DATABASE	243
	A. Pellegrini, F. Pinciroli, R. Rossi and L. Vergani	

SESSION 8	<u>ECG WAVEFORM RECOGNITION</u> C. Marchesi - Chairman	247
	TEMPLATE WAVEFORM RECOGNITION REVISITED. RESULTS FOR THE CSE DATA BASE J.L. Talmon and J.H. van Bemmel	249
	METHODS FOR NOISE TESTING OF ECG ANALYSIS PROGRAMS W. Alraun, Chr. Zywietz, D. Borovsky and J.L. Willems	253
	THE EUROPEAN CSE PROJECT: EXPERIENCES IN THE ITALIAN PROCESSING CENTER G. Bortolan, C. Cavaggion and R.T. Degani	257
	A NEW APPROACH TO DETERMINE THE SAMPLING RATE FOR ECGS Chr. Zywietz, U. Spitzemberger, Chr. Palm and A. Wetjen	261
	THE SPATIAL AREA AS A NEW FUNCTION FOR PRECISE DELIMITATION OF THE WAVES IN 3-LEAD ECGS D. Morlet, P. Rubel, M.C. Forlini and P. Arnaud	265
	A COMPARISON OF ECG MEASUREMENTS DERIVED FROM 3, 6 AND 12 SIMULTANEOUS LEADS G. Bortolan, C. Cavaggion and R.T. Degani	269
SESSION 9	<u>NUCLEAR CARDIOLOGY</u> H.G. Ostrow - Chairman	273
	GATED LIST-MODE ACQUISITION AND MULTIPLE-CRITERIA R-R SELECTION: A NEW RADIONUCLIDE METHOD TO MEASURE POTENTIATION OF LV FUNCTION E.W. Bough, W.E. Boden, L.M. Breindel, S.R. Ruby and E.J. Gandsman	275
	FULLY AUTOMATED EQUILIBRIUM RADIONUCLIDE VENTRICULOGRAPHY: SECTORIAL EJECTION FRACTION AND SECTORIAL PHASE ANALYSIS R. Standke, F.-D. Maul, G. Hor and W.-D. Bussmann	279
	VALIDATION OF QUANTITATIVE PHASE ANALYSIS OF RADIONUCLIDE ANGIOGRAPHY IN PATIENTS WITH ANGINA AT REST P. Marzullo, O. Parodi, M. Galli, D. Neglia, C.R. Bellina and A. L'Abbate	283
	ANALYSIS OF ERROR PROPAGATION IN MULTIHARMONIC FOURIER ANALYSIS OF GATED BLOOD POOL IMAGES USING A MONTE CARLO COMPUTER MODEL J. Machac, S.F. Horowitz, D. Broder and S.J. Goldsmith	287
	THE EFFECT OF DIGITAL PROCESSING ON VOLUME CURVES AND DERIVED PARAMETERS FROM SINGLE PROBE PRECORDIAL SCINTILLATION COUNTING W. Bencivelli, G.J. Davies, M. Morgan, P. Crean, M. Croom, J. Crow, T. Pratt and A. Maseri	291
	LEFT VENTRICULAR FLOW-VOLUME RELATIONS IN NORMAL SUBJECTS AND PATIENTS WITH HEART DISEASE M.V. Green, S.L. Findley, R.O. Bonow, S.L. Bacharach and J.E. Juni	295

WORKSHOP 1	<u>ECG MAPPING</u>	299
	R.V. Essen - Chairman	
	DATA REDUCTION OF BODY SURFACE POTENTIAL MAPS G.J.H. Uijen, A. Heringa and R.Th. van Dam	301
	A BODY SURFACE MAPPING SYSTEM WITH IMMEDIATE INTERACTIVE DATA PROCESSING S.J. Walker, M. Loughhead, P.S. Lavercombe and D. Kilpatrick	305
	CLINICAL APPLICATION OF AN INVERSE PROBLEM MODEL FOR ECG PROCESSING -- ASSESSMENT OF INFARCT SIZE IN ACUTE MYOCARDIAL INFARCTION M. Inoue, M. Hori, M. Fukunami, M. Fujiwara and H. Abe	309
WORKSHOP 2	<u>INTENSIVE CARE AND HEMODYNAMIC MONITORING</u>	313
	W. Rutishauser - Chairman	
	MICROCOMPUTER-ASSISTED SYSTEM FOR MANAGEMENT OF PATIENTS DURING INTRA AORTIC BALLOON PUMPING C. Vassanelli, T. Stafford and P. Zardini	315
	RECOGNITION OF MALIGNANT VENTRICULAR ARRHYTHMIAS: ECG PROCESSING AND LEFT VENTRICULAR INTRA-MYOCARDIAL PRESSURE GRADIENT DETECTION A.E. Aubert, B.G. Denys, H. Ector and H. De Geest	319
	MICROCOMPUTER ANALYSIS OF AMBULATORY INTRA-ARTERIAL BLOOD PRESSURE S. Kalli, J. Heinila, N. Saranummi, V. Turjanmaa and A. Uusitalo	323
	AMBULATORY MONITORING OF THE SYSTOLIC TIME INTERVALS C. Marchesi, C. Palombo, S. Giacconi, A. Macerata, M. Raciti, A. Montereggi and S. Ghione	327
	A FLEXIBLE SYSTEM FOR INTELLIGENT DISPLAY OF ELECTROCARDIOGRAPHIC, PRESSURE AND NUCLEAR MEDICINE DATA RECORDED OVER A PERIOD OF SEVERAL HOURS M.J. Morgan, M. Croom, S. Chierchia and A. Maseri	329
WORKSHOP 3	<u>DIGITAL SUBTRACTION ANGIOGRAPHY</u>	333
	P.H. Heintzen - Chairman	
	DIGITAL ANGIOGRAPHIC DETERMINATION OF RELATIVE BLOOD FLOW FROM A SINGLE INJECTION W. Barrett, H. Hines, P. Scheibe, B. Arnold and H. Eisenberg	335
	DIGITAL IMAGE PROCESSING WITH APPLICATION TO INTRAVENOUS ANGIOCARDIOGRAPHIC IMAGE SERIES L. Rasoamanambelo, M. Fleisch, P.-A. Doriot, P. Chatelain and W. Rutishauser	339
	MYOCARDIAL PERfusion STUDIES BY DIGITAL ANGIOGRAPHY J.H. Bursch, H.J. Hahne, C. Beyer, S. Seemann, L. Meissner, R. Brennecke and P.H. Heintzen	343
	GLOBAL AND REGIONAL COMPARISON BETWEEN STANDARD BIPLANE AND DIGITAL SUBTRACTION ANGIOCARDIOGRAPHY OF THE RIGHT VENTRICLE P.E. Lange, W. Budach, W. Radtke, D.G.W. Onnasch and P.H. Heintzen	347

WORKSHOP 4	<u>CLINICAL ELECTROPHYSIOLOGY</u>	351
	J.M. Jenkins - Chairman	
	A MICROPROCESSOR BASED, ALGORITHM CONTROLLED ANTIARRHYTHMIC AND RATE-RESPONSIVE PACEMAKER	353
	R.M. Donaldson and A.F. Rickards	
	VERSATILE SYSTEM FOR ENDO-EPICARDIAL MAPPING IN SURGERY OF ATRIAL, A-V AND VENTRICULAR ARRHYTHMIAS	357
	C. Hernandez, J. Marquez-Montes, G. Linacero, J.J. Rufilanchas, M.A. Gonzalez, C. Cabo and J.L. Castillo-Olivares	
	INTRA OPERATIVE MAPPING FOR GUIDING ENDOCARDIAL RESECTION IN PATIENTS WITH MEDICALLY REFRACTORY VENTRICULAR TACHYCARDIAS	361
	J.M.T. de Bakker, M.J. Janse, F.J.L. van Capelle and D. Durrer	
WORKSHOP 5	<u>MECHANICAL PROPERTIES OF THE CARDIOVASCULAR SYSTEM</u>	365
	T.A. Pryor - Chairman	
	STUDIES ON THE MECHANICAL PROPERTIES OF THE PULMONARY ARTERY IN VIVO	367
	W. Clas, W. Kasper, R. Ott, H. Hutten and J. Meyer	
	MATHEMATICAL ARTIFACTS IN THE DETERMINATION OF RELAXATION RATES	371
	G. Martin, J.V. Gimeno, J. Cosin and M.I. Guillen	
	A MODEL OF LEFT VENTRICULAR PRESSURE DECAY INCORPORATING ASYNCHRONOUS ONSET OF RELAXATION	375
	R.W. Brower, S. Meij and P.W. Serruys	
WORKSHOP 6	<u>CORONARY ARTERY MEASUREMENTS</u>	379
	H.T. Dodge - Chairman	
	CINEVIDEODENSITOMETRIC MEASUREMENTS OF CORONARY ARTERY FLOW VELOCITY PATTERNS IN MEN	381
	G. Sauer, H. Krause, J. Schenk, U. Tebbe, H. Kreuzer and K.-L. Neuhaus	
	INFLUENCE OF GEOMETRIC ERRORS IN QUANTITATIVE ANGIOGRAPHY ON THE EVALUATION OF STENOTIC HEMODYNAMICS	385
	M. Siebes, H. Lenzen, M. Gottwik and M. Schlepper	
	DEVELOPMENTS TOWARDS FRAME-TO-FRAME COMPUTER PROCESSING OF THE ENTIRE CORONARY TREE	389
	C.J. Kooijman, R.T. Rademaker, J.J. Gerbrands and J.H.C. Reiber	
	CLINICAL ASSESSMENT OF CORONARY ARTERIAL ELASTIC PROPERTIES BY THE IMAGE PROCESSING OF CORONARY ARTERIOGRAMS	393
	M. Hori, M. Inoue, T. Shimazu, M. Mishima, H. Kusuoka, H. Abe, K. Kodama and S. Nanto	

POSTER SESSION

397

OPTIMAL FILTER DESIGN FOR REAL-TIME ARRHYTHMIA DETECTION -- A NEW METHODOLOGY J.Y.J. Wang and E.D. Helfenbein	399
HOW TO ENSURE OPTIMAL EFFICIENCY OF THE CARDIAC CATHETERIZATION DATA BASE S. Ahn, C. van Eyll, A. Ries and J. Sansdrap	403
A MATHEMATICAL MODEL TO STUDY PACEMAKER RELATED TACHYARRHYTHMIAS W. Dassen, P. Brugada, K. den Dulk, A. Gorgels and H. Wellens	407
A COMPUTER-BASED CONFIGURABLE ECG-RECORDER FOR CORONARY CARE UNITS J. Damgaard Andersen and Y. Damgaard	411
AN 8-BIT MICROCOMPUTER FOR ON-LINE ANALYSES OF EXERCISE ELECTROCARDIOGRAMS D. Zazula, K. Turkulin, L. Gyergyek, M. Vezjak, F. Jager and F. Solina	415
BIBLIOGRAPHIC REFERENCES DATA BASE J. Sansdrap, H. Van Mechelen, A. Ries, H. Pouleur and A.A. Charlier	419
MULTIHARMONIC FOURIER ANALYSIS OF VENTRICULAR WALL MOTION FOR THE DETECTION OF REGIONAL ALTERATIONS IN CONTRACTION AND RELAXATION O. Ratib and A. Righetti	423
A PORTABLE MICRÖPROCESSOR-BASED SYSTEM FOR THE ELECTROPHYSIOLOGICAL STUDY OF VENTRICULAR ARRHYTHMIAS S. Rosenthal, H. Garan and J. Ruskin	427
A SIMULATION STUDY OF DISCONTINUOUS PROPAGATION IN CARDIAC MUSCLE B. Victorri, F.A. Roberge, L. Boucher, A. Vinet and J.P. Drouhard	431
TIME DOMAIN ANALYSIS OF REGIONAL BLOOD POOL MOVEMENTS IN VENTRICULOGRAPHY A. Bossuyt, F. De Geeter, R. Luypaert, R. Lepoudre and P. Block	435
AN ALGORITHM FOR RED CELL VELOCITY MEASUREMENTS IN VESSELS OF HEART TRANSPLANTS BY A THREE WINDOW DENSITOMETRIC SIGNAL COMPARISON K.S. Herrmann, H. Krause and H. Kreuzer	437
A LOW-COST ECHOCARDIOGRAPHIC MEASUREMENT AND DATABASE SYSTEM FOR CLINICAL AND RESEARCH APPLICATIONS M.L. Bacchi Reggiani, G.F. Binetti, C. Lamberti and B. Magnani	441
LEFT VENTRICULAR PERFORMANCE EVALUATION WITH COMPUTER AIDED INFRARED CHEST THERMOGRAPHY IN LEFT VENTRICULAR HYPERTRYPHY P. Ravizza, G. Dacquino, L. Divieti and M. Pissarello	445
VENTRICULAR WALL MOTION: THE PROPORTIONAL SHORTENING METHOD C. Lamberti, A. Martelli, G. Binetti, S. Fabii and B. Magnani	449

COMPUTER ASSISTED ANALYSIS OF DIRECT BLOOD PRESSURE TELEMETRY	453
G. Haussinger and K. Bachmann	
VARIABILITY IN MEASURING LEFT VENTRICULAR WALL MOTION: THE EFFECT OF REALIGNMENT	457
F.H. Sheehan, H.T. Dodge, S. Mitten and E.L. Bolson	
MULTIPLE DIPOLE INVERSE SOLUTIONS FROM HUMAN BODY SURFACE ELECTROCARDIOGRAMS	461
D.B. Geselowitz and H.T. Thorsson	
AN ALGORITHM FOR THE RAPID ANALYSIS OF 24-HOUR AMBULATORY RECORDINGS OF INTRAARTERIAL BLOOD PRESSURE	465
P.J. Bones and H. Ikram	
A NEW METHODOLOGY FOR OPTIMAL COMPARISON OF SERIAL VECTOCARDIOGRAMS	467
J. Fayn, P. Rubel and P. Arnaud	
STAT: A SYSTEM FOR RAPID STATISTICAL ANALYSIS OF MEDICAL DATA	471
W.J. Sanders, G.R. Sanders and E.L. Alderman	
LOCALIZATION OF LEFT VENTRICULAR ASYNERGY BY CLUSTERING SEGMENTAL MOTION PATTERNS	475
Z. Bjelogrlic, J. Jakopin and L. Gyergyek	
RAPID DIGITAL ANALYSIS OF THE ST-T SEGMENT OF THE 24-HOUR AMBULATORY ELECTROCARDIOGRAPHIC MONITORING	479
Y. Ichimaru, T. Yanaga, Y. Sato, M. Ichimaru, T. Ueno and K. Otsuka	
RECONSTRUCTION OF 3D-IMAGES AND SELECTED CROSS SECTIONS OF THE HEART	483
P. Jensch, H. Susanto, W. Schneider, W. Ameling, R.v. Essen, H. Lambertz, H. Grenner and S. Effert	
COMPUTERISED DETECTION OF ST SEGMENT CHANGES ON 24 HOUR HOLTER TAPES: COMPARISON WITH COMMERCIAL SYSTEMS	487
A. Gallino, G. Smith, S. Chierchia, M. Croom, M. Morgan, C. Marchesi and A. Maseri	
PROGRAM PARTICIPANT DIRECTORY	491
INDEX BY AUTHOR	497

PLENARY SESSION 1
ECHOCARDIOGRAPHY

CO-CHAIRMEN - N. Bom
Thoraxcentrum, Erasmus University
P. O. Box 1738
3000 DR. Rotterdam
The Netherlands

J. Meyer
II Med. Klinik and Poliklinik
Klinikum der Johannes Gutenberg
Universität
Postfach 3960
6500 Mainz, West Germany

