The Canadian Medical and Biological Engineering Society Conference

La Conference de la Société Canadienne de Génie Biomédical



Proceedings Compte Rendu

9-12 June / juin 1990 Winnipeg, Manitoba

CMBEC 16 ORGANIZING COMMITTEE

CONFERENCE CHAIRMAN:

Monte Raber

SCIENTIFIC PROGRAM CHAIRMAN:

Ed Shwedyk Barry Pask

SCIENTIFIC PROGRAM COMMITTEE:

Art Quanbury

REVIEWERS:

R. Kearney R. Rangayyan

G. Drouin

H. Lee

S. Onyshko

D. Zilm

J. McEwen

B. Graham

R. Gander A.R. Leblanc

A.E. Marble

B. Pask

M. Frize

N. Shrive

P.A. Parker

M. Freese

L. Glantz

A.L. Nickerson

W. Gentles

E.B. Friedman

B. Shykoff

W. Zingg

A. Quanbury

CONTINUING EDUCATION COURSES:

John Wiebe

EXHIBITS AND SPONSORS:

Don Hatch

LOCAL ARRANGEMENTS:

Brian Trenholm Lester Glantz

PUBLICATIONS/FINANCES/SECRETARIAT:

Sally Chapman and Gay Elliott

CMBES Secretariat, Ottawa

ENDORSED BY:

The International Federation for Medical & Biological Engineering.

and

The International Union for Physical and Engineering Sciences in Medicine

TABLE OF CONTENTS

KEYNOTE ADDRESS	
EXPLORING TODAY'S NEW FRONTIERS AND FUTURE PROJECTIONS: "THREE DIMENSIONAL BIOMEDICAL IMAGING", Michael W. Vannier, M.D. (not available)	
Session 1 — Imaging I NEURO-MORPHOLOGY OF BIOLOGICAL VISION AND ARTIFICIAL VISION SYTEMS NEURO-MORPHOLOGY OF VISUAL RECEPTIVE FIELDS: THEORY OF DISCRIMINANT OPERATOR FOR THE EMULATION OF VISUAL RECEPTIVE FIELDS STEREO LITHOGRAPHIC MODEL BUILDING USE OF TOEPLITZ AND BLOCK-TOEPLITZ MATRICES FOR 2-D NON-PARAMETRIC SYSTEM IDENTIFICATION	3 5
Session 2 — Computer Systems COMPUTERS IN MEDICINE: APPROPRIATE USE OF RESOURCES? (not available) DEVELOPMENT OF AN EXPERT SYSTEM FOR THE DIAGNOSIS OF THYROID DISEASES A MOVEMENT PATTERN GENERATOR SCHEME USING NEURAL NETWORKS	9
Poster Session # 1	
A COMPUTER ASSISTED DRUG DELIVERY SYSTEM FOR AMINOGLYCOSIDE ANTIBIOTICS SOFTWARE TOOLKIT FOR COMPUTER-CONTROLLED DRUG INFUSION PUMP AN OPTICAL MOUTH-MOUSE FOR QUADRIPLEGICS A REAL-TIME IMAGE PROCESSING SYSTEM APPLIED TO MEDICAL ULTRASONIC IMAGES	13 15 17 19
DIFFERENT LOADING RATES AND THEIR EFFECT ON THE SLIPPAGE OF HOFFMANN UNIVERSAL JOINTS A HANDHELD MICROCOMPUTER SYSTEM FOR CONTROL OF A JET VENTILATOR	21 23
Session 3 — Imaging – II RECENT ADVANCES IN PORTAL IMAGING DIGITAL IMAGE PROCESSING FOR VERIFICATION OF RADIOTHERAPY TREATMENT BD DIGITAL SUBTRACTION MAMMOGRAPHY QUANTITATIVE ASSESSMENT OF CT PSF ISOTROPICITY AND ISOPLANICITY	25 27 29 31
Session 4 – Rehabilitation – I ON CURRENT ISSUES IN REHABILITATION ENGINEERING ARTIFICIAL MUSCLE PROTOTYPE FOR USE IN ROBOTIC AND PROSTHETIC LIMBS A KNOWLEDGE-BASED APPROACH TOWARDS THE ADAPTIVE CONTROL OF ELECTRIC WHEELCHAIRS HOME-USE ELECTRICAL NERVE AND MUSCLE STIMULATORS: ARE THEY CONSTANT CURRENT OUTPUT DEVICES?	33 35 37
Session 5 — Imaging – III	
COLOUR FLOW DOPPLER IMAGING AND RELATED HEMODYNAMIC OBSERVATIONS A FLUOROSCOPIC IMAGING DEVICE FOR RADIOTHERAPY LOCALIZATION THREE-DIMENSIONNAL (3-D) ANALYSIS AND DISPLAY OF DUAL ISOTOPE MYOCARDIAL SPECT STUDIES: A PHANTOM VALIDATION ON-LINE MOTION ANALYSIS FROM ULTRASONIC IMAGES	41 45 47 49
Session 6 — Physiological Modelling — I	
MATHEMATICAL MODELING IN PHYSIOLOGY	51
A METHOD TO CALCULATE THE WORK OF THE MYOCARDIUM ELECTRIC FIELD INTERACTION BETWEEN CARDIAC MYOCYTES	53 55

A HETERODYNE LASER INTERFEROMETER FOR MEASURING DISPLACEMENTS OF A MEDICAL MICRO-ROBOT LIMB MEASUREMENT OF ADIPOSE TISSUE VOLUME BY MAGNETIC RESONANCE IMAGING USING COMPUTER VISION FOR STEREORADIOGRAPHIC RECONSTRUCTION OF THE SPINE AND RIB CAGE QUANTITATIVE MEASUREMENT OF FLUID FLOW BENEATH A TOURNIQUET CUFF USING MAGNETIC RESONANCE IMAGING	57 59 61 63
Session 8 — Physiological Modelling – II PHYSICAL CONSTRAINTS AND OPTICAL FLOW: APPLICATION TO CORONAROGRAPHY	65
IMPEDANCE SPECTROSCOPY IN ACTIVE CONTRACTING FROG MUSCLES COMPUTER MODEL FOR OXYGEN TRANSPORT PROCESSES A THERMOKINETIC VIEW OF CELLULAR IONIC TRANSPORT	67 69 71
Session 9 — Signal Processing – I QUANTITATIVE ANALYSIS OF THE CLINICAL EEG RULE BASED GRADED ANALYSIS OF 16-CHANNEL AMBULATORY CASSETTE EEGS	73 75
EFFECTS OF ELECTRODE CONFIGURATION AND SPACING ON THE SNR CHARACTERISTICS OF MYOELECTRIC SIGNAL	77
RELIABLE ACQUISITION AND MEANINGFUL ANALYSIS OF THE ELECTROGASTROGRAM ARE STILL ELUSIVE	79
INFLUENCE OF MOTOR UNIT SAMPLE SIZE ON THE VALIDITY OF MOTOR UNIT ESTIMATES	81
Session 10 — Biomechanics – I BIOMECHANICS OF HUMAN MOVEMENT — ITS POTENTIAL AND ITS CLINICAL IMPACT	83
A TECHNIQUE FOR THE CORRECTION OF RELATIVE JOINT ANGLES IN THREE- DIMENSIONS AND ADJUSTING SURFACE MARKERS "INTO" BODY SEGMENTS VALUDATION OF A THREE-DIMENSIONAL KNEE MOTION ASSESSMENT SYSTEM	85 87
MECHANICAL PROPERTIES OF THE HUMAN ARM DURING VOLUNTARY MOVEMENT PLANNING OF UPPER-LIMB MOVEMENTS	89 91
Poster Session # 2 A PHONEMIC RECOGNIZER FOR SPEECH THERAPY USING A NEURAL NETWORK MODEL	93
A HARDWARE DESCRIPTION AND LOGIC CELL ARRAY APPROACH IN DEVELOPMENT ON A SYNCHRONOUS TIMING LOGIC UNIT FOR A TMS32010-BASED REAL-TIME SPEECH PROCESSING SYSTEM	95 97
AN ALARM SYSTEM FOR HIGH-RISK PORTABLE VENTILATOR PATIENTS A SPEECH PROCESSING SYSTEM FOR A SPEECH SPLICER AUTOMATED 4-CHANNEL AMBULATORY CASSETTE EEG ANALYSIS SYSTEM	99 101
Session 11 — Signal Processing – II NERVE CONDUCTION VELOCITY DISTRIBUTION DETERMINATION ADAPTIVE SIGNAL PROCESSING FOR THE REMOVAL OF ECG ARTIFACTS FROM	103
DIAPHRAGM EMGS INTERFERENCE IN DISPLACEMENT VIBROARTHROGRAPHY AND ITS ADAPTIVE	105
CANCELLATION AN INVESTIGATION OF THE EFFECTS OF VELOCITY ON HUMAN MASSETER MUSCLE ELECTROMYOGRAPHY DURING ANTERIOR BITING	107 109
Session 12 — Dental Research A TECHNIQUE TO MEASURE THE PRESSURE DISTRIBUTION PROPERTIES OF THE	111

TEMPOROMANDIBULAR JOINT LOADING IN PATIENTS WITH MANDIBULAR ASYMMETRIES	440
MEASUREMENT OF TONGUE STRENGTH IN THE QUANTITATIVE EVALUATION OF	113
ORAL PHASE DYSPHAGIA	115
AN AUTOMATED POSTERIOR DENTAL RESTORATION SYSTEM — PRELIMINARY RESULTS	117
Session 13 — Signal Processing – III	
USE OF PERSONAL COMPUTERS FOR RESPIRATION ACOUSTIC SIGNAL PROCESSING EMPLOYING SUPRASEGMENTAL ANALYSIS IN THE OBJECTIVE ASSESSMENT OF MOTOR IMPAIRED SPEECH	119
PHONOCARDIOGRAPHIC MONITORING USING A SPECIAL ENDOTRACHEAL TUBE	121 123
DESIGN CRITERIA FOR REPRODUCING K-SOUNDS & OSCILLOMETRIC PULSES IN ARM SIMULATOR	125
Session 14 — Rehabilitation – II	
RESEARCH AND TECHNOLOGY TRANSFER FOR AN AGING POPULATION A BLACKBOARD KNOWLEDGE-BASED APPROACH TOWARDS IMPLEMENTING AN ADAPTIVE FORCE JOYSTICK COMPUTER INPUT DEVICE FOR PERSONS WITH TREMOR DISABILITY	127
HIGH BANDWIDTH, FORCE-REFLECTING HUMAN INTERFACE FOR TELEROBOTICS	129 131
FRACTAL DIMENSION ANALYSIS OF PHYSIOLOGICAL TREMOR	133
Session 15 — Signal Processing – IV	
THE BLOOD PRESSURE VARIABILITY WAVE: AN APPLICATION OF SYNCHRONOUS	
AVERAGING SMOOTHING DISTORTION IN SIDE-STREAM CAPNOGRAPHY	135
A SYSTEM TO DISPLAY THE ACTIVATION SEQUENCE DIRECTLY ON THE HEART	137 139
INSTRUMENTATION FOR SIGNAL-AVERAGED ELECTROCARDIOGRAPHY	141
Session 16 — Instrumentation – I	
AUTOMATED RETRACTION IN THE OPERATING ROOM USING ADVANCED ROBOTICS FAILURE OF HOFFMANN HALF-FRAME FIXATION DEVICES AND ITS RELATION TO	143
UNIVERSAL-JOINT SLIPPAGE AN IMPROVED AMPLIFIER FOR MEASURING HYDROGEN GAS CLEARANCE	145 157
MEASUREMENT OF SPINAL CORD COMPARTMENT PRESSURES: INSTRUMENTATION AND PRELIMINARY RESULTS	149
Session 17 — Physiological Modelling – III	
A REVIEW OF MODELLING APPROACHES FOR VESTIBULAR NYSTAGMUS	151
MODEL BASED NYSTAGMUS DETECTION	153
AN APPROACH TO FINITE-ELEMENT MODELLING OF THE STRUCTURAL-ACOUSTIC INTERACTION BETWEEN THE EAR CANAL AND EARDRUM	155
SENSITIVITY OF STENOSIS LOCATION IN THE CAROTID VASCULAR SYSTEM	157
Session 18 — Rehabilitation – III THE ENGINEER'S ROLE IN THE REHABILITATION OF PHYSICALLY DISABLED	
PERSONS	159
THE EFFECT OF ELBOW JOINT RESTRICTION ON FUNCTIONAL UPPER LIMB MOTION DURING PERFORMANCE OF THREE FEEDING ACTIVITIES	161
JOINT MECHANICAL IMPEDANCE IN THE DEVELOPMENT OF A MODEL OF WRIST JOINT FUNCTION	163
A WRIST-MOUNTED AIRJET FOR STUDYING HUMAN ARM JOINT MECHANICAL PROPERTIES	165
Session 19 — Instrumentation – II	
DESIGN AND EVALUATION OF A NEW RESPIRATORY MONITOR	167
A HIGH PERFORMANCE DISTRIBUTED RIGHTDICAL LO EVETEM	1.00

A CRITERION FOR THE QUALITY ASSURANCE OF SAFETY & PERFORMANCE INSPECTIONS	171
CENTRE FOR THE ADVANCEMENT OF MEDICAL DEVICE TECHNOLOGY AT UNIVERSITY HOSPITAL	173
Session 20 — Biomechanics – II	
DYNAMICS OF HUMAN ELBOW JOINT STIFFNESS	175
IDENTIFICATION OF THE TIME-VARYING STIFFNESS OF THE HUMAN ANKLE	177
NON-PARAMETRIC JOINT INPUT/OUTPUT IDENTIFICATION: APPLICATION TO THE	
PERIPHERAL NEUROMUSCULAR SYSTEM	179