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The International Federation for Medical and Biological Engineering, IFMBE, is a federation of national and transnational organizations representing internationally the interests of medical and biological engineering and sciences. The IFMBE is a non-profit organization fostering the creation, dissemination and application of medical and biological engineering knowledge and the management of technology for improved health and quality of life. Its activities include participation in the formulation of public policy and the dissemination of information through publications and forums. Within the field of medical, clinical, and biological engineering, IFMBE's aims are to encourage research and the application of knowledge, and to disseminate information and promote collaboration. The objectives of the IFMBE are scientific, technological, literary, and educational.

The IFMBE is a WHO accredited NGO covering the full range of biomedical and clinical engineering, healthcare, healthcare technology and management. It is representing through its 58 member societies some 120.000 professionals involved in the various issues of improved health and health care delivery.

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About IFMBE

The International Federation for Medical and Biological Engineering (IFMBE) was established in 1959 to provide medical and biological engineering with a vehicle for international collaboration in research and practice of the profession. The Federation has a long history of encouraging and promoting international cooperation and collaboration in the use of science and engineering for improving health and quality of life.

The IFMBE is an organization with membership of national and transnational societies and an International Academy. At present there are 52 national members and 5 transnational members representing a total membership in excess of 120000 worldwide. An observer category is provided to groups or organizations considering formal affiliation. Personal membership is possible for individuals living in countries without a member society The International Academy includes individuals who have been recognized by the IFMBE for their outstanding contributions to biomedical engineering.

Objectives

The objectives of the International Federation for Medical and Biological Engineering are scientific, technological, literary, and educational. Within the field of medical, clinical and biological engineering it's aims are to encourage research and the application of knowledge, and to disseminate information and promote collaboration.

In pursuit of these aims the Federation engages in the following activities: sponsorship of national and international meetings, publication of official journals, cooperation with other societies and organizations, appointment of commissions on special problems, awarding of prizes and distinctions, establishment of professional standards and ethics within the field, as well as other activities which in the opinion of the General Assembly or the Administrative Council would further the cause of medical, clinical or biological engineering. It promotes the formation of regional, national, international or specialized societies, groups or boards, the coordination of bibliographic or informational services and the improvement of standards in terminology, equipment, methods and safety practices, and the delivery of health care.

The Federation works to promote improved communication and understanding in the world community of engineering, medicine and biology.

Activities

Publications of IFMBE include: the journal *Medical and Biological Engineering and Computing*, the electronic magazine *IFMBE News*, and the Book Series on Biomedical Engineering. In cooperation with its international and regional conferences, IFMBE also publishes the IFMBE Proceedings Series. All publications of the IFMBE are published by Springer Verlag. The Federation has two divisions: Clinical Engineering and Health Care Technology Assessment.

Every three years the IFMBE holds a World Congress on Medical Physics and Biomedical Engineering, organized in cooperation with the IOMP and the IUPESM. In addition, annual, milestone and regional conferences are organized in different regions of the world, such as Asia Pacific, Europe, the Nordic-Baltic and Mediterranean regions, Africa and Latin America.

The administrative council of the IFMBE meets once a year and is the steering body for the IFMBE: The council is subject to the rulings of the General Assembly, which meets every three years. Information on the activities of the IFMBE can be found on the web site at: http://www.ifmbe.org.

Foreword

On behalf of the steering and organizing committees I would like to welcome you to sunny Miami Florida for the 25th Southern Biomedical Engineering Conference. This year we are excited to have visitors from all over North America, South American, Europe and Asia to share exciting developments in all areas of Biomedical Engineering. The main objective of this conference is to bring together students, researchers and clinicians in Biomedical Engineering to disseminate technical information in this rapidly growing field, and provide a forum consisting of established as well as new and future researchers in this exciting engineering field.

This year's meeting features more than 140 high quality papers, many by students, for oral presentations and publication in the conference proceedings. The conference owes its success to the dedicated work of the keynote speakers, conference chairs, authors, participants, students, organizers, and the College of Engineering and Computing webmaster. We wish to especially acknowledge the work of the peer reviewers, program committee, staff of the BME Department, and the student organizing committee.

We also wish to acknowledge the sponsorship of the National Science Foundation and the International Federation of Medical and Biological Engineering, and Simpleware, Ltd.

We hope that you enjoy your experience, make new collaborations and lasting friendships.

Anthony J. McGoron, PhD
SBEC 2009 Chair

Conference Details

Organized by

Florida International University, Department of Biomedical Engineering, College of Engineering and Computing
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About SBEC

The First Southern Biomedical Engineering Conference was held at the Louisiana State University Medical Center in Shreveport, Louisiana June 7 and 8, 1982 and was organized by Dr. Subrata Saha, who founded this conference series. The conference was started to bring together engineers and scientists in the South with interest in biomedical applications and showcase development in the emerging field of biomedical engineering. It has grown into not only a regional conference, but an international conference with participants from every part of the United States, Canada, South America, Europe, and Asia. The aim of this conference is to bring together researchers, clinicians, students, and industry leaders to discuss current ideas and concepts in biomedical research. The program includes keynote lectures, presentations in diverse areas of biotechnology, and student competitions.

Even though this was originally intended as a regional conference, attendance from all regions of US, Latin America and the world is strongly encouraged and welcomed. An important incentive of the Southern Biomedical Engineering Conference is that it is not as large as many of the other international meetings, so that interactions between students and prominent biomedical engineers from many diverse fields are facilitated. These interactions are key to the field's continued development and advancement, and they provide an excellent platform for networking and exchanging ideas.

About the University

Florida International University is Miami-Dade County's first public, four-year university. Its powerful record of innovation and research continues to improve the quality of life in its communities. FIU opened for classes in 1972 with 5,667 students - the largest opening day enrollment in U.S. collegiate history. Today it has more than 38,000 students, 1,000+ full-time faculty and more than 134,000 alumni. FIU is one of the 25 largest universities in the nation, based on enrollment.

The College of Engineering and Computing at Florida International University continues to be the top producer of Hispanic engineers at all levels from BS to PhD in the Continental US. FIU ranks 6th among all engineering colleges in the nation in BS degrees awarded to African Americans, and 3rd in percentages of PhD degrees granted to women. According to the ASEE 2007 Profiles of Engineering and Engineering Technology Colleges our college ranks 5th among all engineering schools in the ratio of doctoral degrees to research expenditures. This year marks the 10 anniversary of Biomedical Engineering program at FIU and the 6th anniversary of the establishment of the Department of Biomedical Engineering. Of the eleven universities in the State University System of Florida, FIU is the only university with the full slate of programs (BS, MS, PhD) in Biomedical Engineering.

The FIU College of Medicine, South Florida's only public medical school, is transforming the future of public health and educational opportunity in the region. Created in 2006 amid pressing community health concerns and a projected critical shortage of physicians nationally, the College of Medicine is developing a curriculum that reflects an innovative, 21st century approach to health care and medical education.

About Miami

Described as the only great city of the world that started as a fantasy, Miami, with its subtropical climate, naturally protected harbor, and spectacular beaches, has traditionally been a haven for tourism. Since the late 1980s, however, the city has sustained unprecedented growth and, while transforming its image, has emerged as a center of international finance and commerce and as a regional center for Latin American and Haitian art. An unincorporated village shortly before the turn of the twentieth century, Miami boasts a metropolitan area that includes a large unincorporated area and 30 incorporated areas or municipalities, all of which make up Miami-Dade County. Greater Miami offers a diversity of lifestyles and attractions to both residents and visitors in a variety of small towns and cities such as Coconut Grove, Miami Beach, South Beach, Coral Gables, and Bal Harbor. With easy access to other parts of the country, Miami has developed into one of America's major transportation hubs, and today it is a year-round city that offers something for everyone.

Contents

Session 1:
Optical Imaging

Fluorescence Tomographic Imaging Using a Hand-Held Optical Imager: Extensive Phantom Studies 1
J. Ge, S.J. Erickson, and A. Godavarty

Clinical Translation of a Novel Hand-Held Based Optical Imager: *In Vitro* **and** *In Vivo Studies* ... 3
S.J. Erickson, J. Ge, A. Sanchez, and A. Godavarty

Real-Time Imaging of Circulating Individual Blood Cells in Mammalian Embryos with Doppler SSOCT 5
K.V. Larin, I.V. Larina, S. Ivers, S. Syed, and M.E. Dickinson

Brain Connectivity Studies of Joint Attention Using Frequency-Domain Diffuse Optical Imaging 7
U. Chaudhary, B. Zhu, and A. Godavarty

Novel Video-FRAP Method for the Determination of Anisotropic Diffusion: Principles and Optimization 9
F. Travascio and W.Y. Gu

Ultra High-Resolution Optical Coherence Tomography for Ocular Imaging of Small Animals 11
M. Ruggeri, S. Jiao, James C. Major Jr., C. Cebulla, P. Rosenfeld, G. Gregori, G. Tsechpenakis, J. Wang, T. Murray, and V. Porciatti

Session 2:
Instrumentation, Signals and Systems

Incorporation of Interoperability in a Robot-Assisted Orthopedic Surgery System 13
M. Vanicatte, S.M. Krishnan, D. Arney, I. Lee, and J.M. Goldman

Exploring the Effects of Cognitive Load on Muscle Activation during Functional Upper Extremity Tasks 17
D.E. Nathan and D.C. Jeutter

Design and Evaluation of a Three Dimensional Ultrasound System for Tissue Ablation for Treatment of Kidney Tumors 19
K. Lweesy, L. Fraiwan, A. Shatat, G. Abdo, A. Dawodiah, and M. Sameer

Design and Construction of a Novel Surgical Instrument Applicable in Esophagectomy 21
S.H. Farkoush, S. Najarian, G.D. Emamieh, and S. Sarkar

Session 3:
Biomechanics and Biomaterials

Additive Layered Manufacturing of Reticulated Ti-6Al-4V Biomedical Mesh Structures by Electron Beam Melting 23
L.E. Murr, S.M. Gaytan, F. Medina, M.I. Lopez, E. Martinez, and R.B. Wicker

Osteointegration of HA-Coated Subperiosteal Dental Implants: Preliminary Work 29
M.C. Ibanez, C. Bourgeois, J.E. Lemons, and A.W. Eberhardt

Nanoscale Hole Fabrication in Cylindrical Devices for Bubble Generation 31
C. Rodriguez, C. Khanal, and R. Panepucci

Corrosion Behavior of Electropolished and Non-electropolished Ternary Nitinol Alloys 33
W. Haider, N. Munroe, C. Pulletikurthi, and P.K.S. Gill

Flowchart for Basic Non-destructive Testing Technologies in Biomaterials 35
S.H. Kurra, J.M. Zhang, and A. Pennathur

Session 4:
Rehabilitation

The Effects of Visual and Verbal Feedback upon Gait Biomechanics and Functionality 39
J.L. Kenia, M. Mokha, K. Ludwig, and P. Poczwardowski

Analysis, Assessment, and Evaluation of Postural Instability for Bipedal Locomotion 45
G.S. Contreras, A. Trejo, and T. Sarkodie-Gyan

Dynamic Response of Wheelchair Cushions 47
B.M. Chung

Force Production and Neuromuscular Function in Bilateral Movements among Young Females at Low and High Speeds 51
U. Kuruganti and V. Chester

Trunk Kinematics during Pediatric Gait 55
V. Chester and U. Kuruganti

Session 5:
Image Processing and Instrumentation

A Respiratory Gating System for PET Imaging of Lung Cancer 59
M.F. Georgiou, Q. Shen, J. Bohórquez, W. Zhao, R.A. Kuker, and G.N. Sfakianakis

Quantitation of Metabolic Change in Serial FDG-PET Brain Scans of Pediatric Patients with Traumatic Brain Injury 61
M.F. Georgiou, R.A. Kuker, J. Kuluz, and G.N. Sfakianakis

Comparison of Respiratory Motion Correction Methods in PET Lung Tumor Quantification ... 63
J. Wang, J. Franquiz, and A. McGoron

Using Two-Dimensional Edge Detection to Produce Three-Dimensional Medical Prototypes from MRI Data 67
J.E. Urban and J.T. Tester

New Image Processing Algorithm for ROI Extraction in Patients with Rheumatoid Arthritis 71
S. Choi, S.-J. Hong, G.-J. Lee, J.-H. Park, S. Kang, B. Oh, and H.K. Park

A Novel Method to Study DICOM Tags and Definitions for Structured Report and Image Analysis Purposes 73
A. Moein and K. Youssefi

Session 6: Instrumentation, Signals and Systems

Visual Display for the Acquisition of High Rate Pattern Reversal Electroretinograms 75
J. Toft-Nielsen, J. Bohórquez, and Ö. Özdamar

System to Control Skin Temperature during Hyperthermic Treatment 77
E.M. O'Brien and S. Hyun

Design of Interoperability-Coupled Safe Infusion Therapy in a Telemetry Setting 81
S.M. Krishnan, M. Vanicatte, D. Arney, I. Lee, and J.M. Goldman

Endobronchial Intratumoral Chemotherapy (EITC) for Improved Treatment of Lung Cancer 85
E.P. Goldberg, S.I. Celikoglu, and F. Celikoglu

Evaluation of the Electromagnetic Compatibility of WiFi Technology with Life-Supporting Medical Devices 87
G. Calcagnini, E. Mattei, F. Censi, M. Triventi, R. Lo Sterzo, E. Marchetta, V. Marchese, M. Rubino, and P. Bartolini

Performance of Optimal IMC and PID Controllers for Blood Pressure Control 89
S. Enbiya, A. Hossain Member IEEE, and F. Mahieddine

Session 7: Orthopedics

Biomechanical Evaluation of the Cylindrical TI Mesh Cage for the Treatment of Segmental Defects of the Tibia 95
P.A. Ostermann, L.L. Latta, L. Biedermann, and E.L. Milne

A-Mode Ultrasound Bone Registration for Computer-Assisted Knee Surgery: Calibration and Robustness Test 97
T.C. Chang, A. Mozes, L. Arata, and W. Zhao

Biomechanical Analysis of UCBL with Articulated Ankle AFO in a Surgical Stage II Posterior Tibial Tendon Dysfunction 101
M. Diamond, A. Bonner, D. Pedroso, E. Milne, and L. Latta

Investigating the Tightening Torque of an Osseointegrated Transfemoral Implant System 103
M.L. Thompson and C.K. Mechefske

Effects of Temperature on the Performance of Footwear Foams Subjected to Quasi-Static Compression Loading 107
M.R. Shariatmadari, R. English, and G. Rothwell

Session 8: Nanomaterials

Identification of Biomarkers for Multi-walled Carbon Nanotube Exposure in Mouse Macrophage Cells 111
K.D. Houston, N.H. Mack, S.K. Doorn, and M.S. Park

Development of Cell Impedance Based Sensing System for the Nanotoxicity Assay 113
E. Hondroulis and C. Li

Characterization of Nanometric Qdots by AFM and Optical Microscopy 115
S. Kotova, Q. Vu, P.D. Smith, and A.J. Jin

Macrophage Response to Zinc Oxide Nanorod Surfaces - Topography and Toxicity 119
T. Zaveri, N. Dolgova, B.H. Chu, J. Lee, T. Lele, F. Ren, and B.G. Keselowsky

Adhesion Dynamics of Functional Nanoparticles for Targeted Drug Delivery 121
S. Shah, Y. Liu, W. Hu, and J. Gao

Session 9: Algorithms - Neural

The Merit of Principal Component Analysis in fMRI Language Pattern Recognition for Pediatric Epilepsy 123
X. You, M. Guillen, and M. Adjouadi

A New Algorithm as an Extension to the Gradient Descent Method for Functional Brain Activation Classification 125
M.Z. Goryawala, M.R. Guillen, X. You, and M. Adjouadi

Classification of Typical and Atypical Language Network Activations Using Nonlinear Decision Functions 129
M.R. Guillen, M. Adjouadi, M. Goryawala, and W. Gaillard

Enhance Signal Detection in Auto-Associative CA3 Pyramidal Neuron Model Using Electric Field Noise 131
D.G. Rao and A.W.L. Chiu

Clinical Applications of Evoked Potential Continuous Loop Averaging Deconvolution (CLAD) 133
J. Bohórquez, Ö. Özdamar, R. McNeer, and K. Morawski

The Use of Modified Deconvolution Averaging Algorithm for the Analysis of Auditory Evoked Activity 135
A. Presacco, J. Bohórquez, E. Yavuz, and Ö. Özdamar

Session 10: Sensors

Computational Modeling of Implantable Power Source: Miniature Enzymatic Biofuel Cell 137
Y.S. Parikh, J. Yang, and C. Wang

Novel Sensor for Measuring Sodium Concentration for Dialysis Applications 139
L. Furby, A. Mahajan, J. Don, and B. Schwartz

Integrated Sensing Biosystems 141
G.J. Morales and S.D. Morgera

An Investigation of the Electrical Properties of Titanium Oxide Coatings for Potential Use in Biosensors 143
J. Torres, J. Sweeney, A. Barreto, A. Perez, and J. Barreto

Analysis of Pullout Strength and Pedicle Screw Loosening from Loading Rigid Rod Construct 145
D. Kaimrajh, A. Barreto, L.L. Latta, and E.L. Milne

Session 11: Orthopedics

A Self-healing PMMA Bone Cement: Influence of Crystal Size of Grubbs' Catalyst 147
P. Biggs, L. Jones II, B. Wellborn, and G. Lewis

Temperature Calculations in Orthogonal Cutting of Cortical Bone Using Finite Element Analysis 151
K. Alam, A.V. Mitrofanov, M. Bäker, and V.V. Silberschmidt

Development of MR Fluid for Running Shoes with an Active Damping System 153
F. Mastrandrea, G. Franceschini, V. Carnevali, J.M. Kenny, and A. Iannoni

Use of PVA to Improve Adhesion of CaP Coating on Titanium Implants 155
G. Ungan, F. Ak Azem, and A. Cakir

Modes of Failure in Natural and Artificial Human Hip Joints 157
A.E. Yousif

Session 12: Drug Delivery and Tissue Engineering

A Novel Cell Culture Platform for In-Vitro Enhancement of Oxygen Delivery Leads to Improved Physiological Function of Isolated Islets of Langerhans 163
C. Fraker, C.L. Stabler, K. Asfura-Gattas, and J. Dominguez-Bendala

Optimization of Perfluorocarbon Emulsions for Cellular Encapsulation 165
C. Fraker and C.L. Stabler

Effect of Electrode Geometry on Deep Brain Stimulation: Monopolar Point Source vs. Medtronic 3389 Lead 167
T. Zhang and W.M. Grill

Measurement of Ion Diffusivity in Intervertebral Disc Using a Two-Point Electrical Conductivity Approach 171
A.R. Jackson, T-Y. Yuan, C-Y. Huang, and W.Y. Gu

Neurite Growth in Protein-Conjugated Poly(Ethylene Glycol) Hydrogels 173
L.M. Marquardt, R.A. Scott, and R.K. Willits

Maximization of Growth and Storage of Locally Isolated *Lactobacillus Salivarius Subsp. Salivarius* **with High Stability and Functionality** 175
N.K.M. Salih, A. Hutari, W.S. Gaseem, and W.M.W. Yusoff

Session 13: Optical Imaging

Rapid Prediction of Sudden Death Using Fluorescent Nanoparticles 179
M. Kelley and L. Tang

Development of a PLGA Nanoparticle Drug Delivery System Containing Imaging/Hyperthermia and Chemotherapy Agents 183
R. Manchanda, A. Nagesetti, A. Fernandez-Fernandez, and A.J. McGoron

Micro-Object Detection with the Waveguide Microgripper 185
A. Bhanushali, J. Martinez, T. Liu, B. Ryan, and R. Panepucci

Optical Characterization with the Waveguide Microgripper 187
T. Liu, A. Bhanushali, J. Martinez, A.J. McGoron, and R.R. Panepucci

Integrating Technology in a Biostatistics Course at Florida International University 189
R. Gomez

The Goals of Entrepreneurship 193
M. Lenart and P. Tarjan

Session 14: Sensors

Electrochemical Immunosensor for the Direct, Reagentless Detection of Tumor Biomarkers 195
S. Prabhulkar, S. Alwarrapan, G.M. Naja, and C. Li

Using Nano-sensors in Environmental Radionuclide Monitoring 197
R. Banerjee, Y. Katsenovich, G.M. Naja, and C. Li

Development of Gold Nanorod Lateral Flow Test for Quantitative Multi-analyte Detection 199
M. Venkataramasubramani and L. Tang

DNA Biosensors for E. Coli O157:H7 Detection in Drinking Water Resources Using Sol-Gel Derived Waveguides 203
Z.B. Bahşi, A. Buyukaksoy, M.H. Aslan, and A.Y. Oral

Session 15: Orthopedics

Use of a Spine Robot to Simulate Pure Moment Testing for Spine Biomechanics 207
K.D. Fraysur, B.P. Kelly, and D.J. DiAngelo

Robotic Biomechanical Testing of Cervical Spine Structures 211
J.M. Hollis and S. Kolakanuru

Biomechanical Testing of Posterior Lumbar Stabilization Systems 213
B.K. Dhillon, K. Fraysur, K. Sedacki, M. Ammerman, B.P. Kelly, and D.J. DiAngelo

Does Placement of the Axis of Rotation of the Cervical Spine Affect Mechanics during Flexion and Extension? 219
K. Sedacki, K. Fraysur, H. Bonin, B. Kelly, and D. DiAngelo

Biomechanical Comparison of Lumbar Disc Prostheses: ProDisc-L, Charité, and Maverick Disc Implant Systems 223
D.M. Wido, B.P. Kelly, K.T. Foley, B. Morrow, P. Wong, K. Kiehm, A. Sin, R. Bertagnoli, and D.J. DiAngelo

A Statical Model of the Human Knee Joint 227
A.E. Yousif and S.R.F. Al-Ruznamachi

Session 16: Tissue Engineering

Design and Development of a Highly Macroporous Silicone Scaffold as a Bioartificial Pancreas for Type 1 Diabetes 233
E. Pedraza, C. Fraker, A.C. Brady, and C. Stabler

Modeling Bio-Scaffolds: Structural and Fluid Transport Characterization Based on 3D Imaging Data 235
L. Hao, D.R. Raymont, B. Notarberardino, G. Tabor, P.G. Young, I. Turner, and A. Harkara

Session 17: Algorithms - Modeling

Analysis of Microarray Data for Gene Selection 237
F. George and K.M. Ramachandran

Computer-Assisted Bacterial Identification Using 16S rRNA Sequence Data 239
G. Gonzalez, M. Doud, K. Mathee, and G. Narasimhan

Model of the Isolated Ex-Vivo Human Crystalline Lens Using Cosine Functions 241
R. Urs, A. Ho, F. Manns, and J.M. Parel

A Numerical Method for MRI Induced Heating Evaluation in Subjects Implanted with Metallic Wires 243
E. Mattei, G. Calcagnini, F. Censi, M. Triventi, and P. Bartolini

Monte Carlo Calculation for Initial Activity Uniformity Distributed on a Re-188 Electroplated Aluminum Sheet 245
S. Gao and H.J. Zhang

A Reference Model Based Patient Management System: Opportunities and Challenges 247
R. Shankar and S. Islam

Session 18:
Instrumentation, Signals and Systems

Locating Equivalent Cardiac Electrical Activity from ECG for Preliminary Diagnosis 253
E. Morales, J.H. Pierluissi, M. Gomez, and Z. Abedin

Comparative Analysis of Noninvasively Monitored Biosignals for Affective Assessment of a Computer User 255
Y. Gao, A. Barreto, and M. Adjouadi

Measurement of Modulated Autofluorescence Signals in Flow Cytometry 261
J.P. Houston, C.K. Sanders, A. Trujillo, M.A. Naivar, and J.P. Freyer

Blood-Brain Barrier In Vitro Model Utilizing Immortalized Cell Lines 263
Z. Zhang, E. Crumpler, and C. Li

HRV and EEG Signal Features for Computer-Aided Detection of Sleep Apnea 265
E.F. Estrada, H. Nazeran, and H. Ochoa

Assessment of Human Muscle Fatigue from Surface EMG Signals Recorded during Isometric Voluntary Contractions 267
C.M. Potes

Time-Domain Analysis of the ECG P-Wave after External Cardioversion for Persistent Atrial Fibrillation 271
F. Censi, G. Calcagnini, M. Triventi, E. Mattei, P. Bartolini, I. Corazza, and G. Boriani

Session 19:
Modeling - Mechanics

Computational Wear Damage Analysis on Retrieved Tibial Components 273
N. Camacho, L. Trueba Jr., and S.W. Stafford

Effect of Spinous Process Excision on Adjacent Segment Motion: A Biomechanical Study 279
J. Mitgang, M. Wilker, and M. Gerling

Studying the Non-uniform Expansion of a Stent Influenced by the Balloon 281
J. Yang, M.B. Liang, N. Huang, Y.L. Liu, and S. Shah

A Mathematical Head/Brain Model for Investigation of Damping Characteristics of SAS in Low Velocity Head Impacts 283
S.M. Baghaei, A.M. Sadegh, and S.M. Rajaai

Computational Modeling for CAD Data Integration into 3D Image Data 287
P.G. Young, S.R.L. Coward, G. Tabor, J. Kennedy, B. Chen, and A. Harkara

Using FE for Dynamic Energy Return Analysis of Prosthetic Feet during Design Process 289
R. Figueroa and C.M. Müller-Karger

Pressure Response Analysis in Head Injury 293
P.G. Young, L. Beldie, B. Walker, and R.T. Cotton

Effect of Different Boundary Conditions on the Reaction Forces in a Complete Denture 295
A. Yalpaniyan and M.S. Mehr

Session 20: Cardiovascular Systems

Multiscale Mathematical Modeling of Microvascular Tone Regulation 297
A. Kapela, T. Gadkari, S. Nagaraja, and N.M. Tsoukias

Application of a Fluorescent Multiple Indicator Method to Study Changes in Cardiac Permeability with Chemotherapy 299
A. Fernandez-Fernandez, A.J. McGoron, and D. Carvajal

Nitric Oxide Interactions with Red Blood Cell Hemoglobin in a Novel Bioreactor 301
P. Deonikar and M. Kavdia

Transport of Vascular Microbubbles through Multiple Vessel Bifurcations: A Model Study 305
D.T. Valassis, R.E. Dodde, B. Eshpuniyani, J.B. Fowlkes, and J.L. Bull

Resuscitation from Traumatic Hemorrhagic Shock with Na+/H+ Exchanger Inhibitor 307
D. Wu, H. Dai, J. Arias, L. Latta, and W.M. Abraham

Real Time Monitoring of Extracellular Glutamate Release in Rat Ischemia Model Treated by Traditional Acupuncture 309
G.J. Lee, S.K. Choi, C.S. Yin, S. Choi, J.E. Lim, J.H. Park, B.S. Oh, and H.K. Park

Session 21: Algorithms - Cardiovascular

Exercise Evaluation from Blood Volume Pulse Signals Analyzed by Parametric Auto-Regressive Modeling 311
A.S. Mann and A. Barreto

Development of Matlab Algorithm to Process Pressure Waveforms from Isolated Perfused Heart Experiments 315
D.A. Carvajal, A. Fernandez-Fernandez, and A.J. McGoron

An Integrated Software Package to Classify Human Respiratory Diseases 317
N. Hafezi, H. Nazeran, E. Meraz, P. Nava, and M. Goldman

Respiratory System Model Parameters Track Changes in Lung Function after Bronchodilation 319
E. Meraz, H. Nazeran, M. Goldman, and B. Diong

Feature Selection of Voluntary Cough Patterns for Detecting Lung Diseases 323
A.A. Abaza, A.M. Mahmoud, J.B. Day, W.T. Goldsmith, A.A. Afshari, J.S. Reynolds, and D.G. Frazer

Multi-outcome Modeling and Decisions for Anesthesia Patients 329
Z.B. Tan, R. Kaddoum, L.Y. Wang, and H. Wang

The Health Advisor 333
C.A. Mazoleny and R. Shankar

Session 22: Rehabilitation

Symmetry of Weight Distribution While Rising from a Chair in Transtibial Amputees 339
V.R. Agrawal, C.A. O'Toole, I.A. Gaunaurd, and R. Gailey

Fast Differential Analysis of Center of Pressure Data in Normal Children and Children with Cerebral Palsy 341
G. Kim, M. Ferdjallah, and G.F. Harris

Design of a Prototype for a Novel Rehabilitative Device for Hearing Preservation through Feedback and Control 343
A. Biswas and E. MacDonald

Posture Stability in Lateral Slope Walking 347
L.H. Wang, H.M. Hsieh, C.Y. Huang, Y.C. Peng, and F.C. Su

Mandibular Advancement Device (MAD®) to Treat Sleet Apnoea-Hypopnoea Syndrome and Chronic Snoring 349
J.M. Cobo, F. de Carlos, and A.A. Suárez

Session 23: Drug Delivery

Injectable and Release-Controlled OP-1 Hybrid Core-Shell Nanocapsules Enhance Distraction Osteogenesis in Rabbits 355
Z.S. Haidar, R.C. Hamdy, and M. Tabrizian

Quantified In Vitro Release of Interleukin-8 from Electrospun Bioresorbable Vascular Graft Materials 359
P.S. Wolfe, S.A. Sell, K. Garg, and G.L. Bowlin

Targeted Drug Delivery with PEGylated Immuno-Niosomes 363
J.A. Elliott, B. Flam, K. Muffly, J.A. Strom, E. Hood, and M.D. VanAuker

Injectable Cell-Biopolymer Gels for Neural Tissue Repair 367
S.R. Barnes, D.R. Walker, and E.P. Goldberg

Nanostructured Biopolymer-Microglial Cell Implants for Spinal Cord/CNS Repair 369
J.B. Stopek, W.J. Streit, J.P. Mickle, and E.P. Goldberg

Optimization and Scheduling for Chemotherapy Treatment to Control Tumour Growth 371
S. Algoul, A. Hossain, and M.A.A. Majumder

Numerical Study of Temperature and Thermal Dose Response of Tumor Tissue during Hyperthermia Treatment 377
P.R. Sharma, S. Ali, and V.K. Katiyar

Author Index 379

Keyword Index 383

Fluorescence Tomographic Imaging Using a Hand-Held Optical Imager: Extensive Phantom Studies

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Abstract— **Hand-held probe based optical imager has become popular towards breast imaging for its potential portability and maximum patient comfort (no compression involved), but are currently limited on three-dimensional (3-D) tumor localization. A novel hand-held probe based optical imager with unique source and detector set-up was recently developed in our laboratory towards tomographic breast imaging. With 3-D fluorescence tomography feasibility of this novel optical imager demonstrated in previous studies, extensive phantom studies under various conditions were performed to assess current system limitation on 3-D tumor/target recovery. The phantom studies have been performed on slab geometries (650 ml) under different target depths (1-2.5 cm), target volumes (0.45, 0.23 and 0.10 cc), fluorescence absorption contrast ratios (1:0, 1000:1 to 5:1), and number of targets (up to 3), using Indocyanine Green (ICG) as the fluorescence contrast agent. The fluorescence optical measurements acquired on phantom surface were applied towards an Approximate Extended Kalman Filter (AEKF) algorithm for 3-D mapping of fluorescence absorption coefficient over entire phantom volume. In most cases, the target was successfully reconstructed. Currently, the limitations in terms of resolution, depth, and volume recovery of the embedded target are assessed. Upon further experimental validation based on in-vitro and in-vivo studies, the clinical translation of this technology is promising.**

Keywords— **Fluorescence, Tomography, Hand-held Probe, Optical imaging, phantom.**

I. Introduction

Fluorescence-enhanced diffuse optical tomography (FDOT), which utilizes a molecularly targeting fluorescent agent to enhance the intrinsic optical contrast, has been employed for different medical/clinical applications [1]. Different instrumentations of optical imaging have been developed towards different applications, among them the hand-held probe based system is of a new interest for its maximum patient comfort and potential portability [2]. However, most of hand-held probe systems were aimed for tissue spectroscopic characterization with very limited spatial resolution. The 2-D and 3-D tomographic study of hand-held probe based optical system has only been performed by two research groups. Zhu et al [3] was able to perform 3D reconstruction tomographic studies guided by ultrasound. Another research group (Our group) recently demonstrated the feasibility of 3D tomography studies using a hand-held probe optical imager without guidance from other modality [4]. Our hand-held probe based imager employed 6 source points and 165 detection points for a unique simultaneous illumination and collection geometry. In the preliminary liquid phantom studies, the fluorescing targets of 0.45 cm^3 were able to be recovered at target depth 1.5 cm and 2 cm. In this paper, extensive phantom under various target depth, volume and target/background contrast ratio were performed using same optical imager for assessing system recovery limitation on tissue phantoms.

II. Materials and methods

A. Instrumentations

A hand-held probe based ICCD (intensified charge-coupled device) optical imager was used in extensive phantom studies. This system mainly consists of a laser diode ((80mw, Sanyo DL7140-201S, Thorlabs Inc., Newton, NJ), an image intensifier (FS9910, ITT Night Vision, VA) that is optically coupled to a 16-bit frame transfer CCD camera (PI-SCX 7495-0002, Roper Scientific, Trenton, NJ) and a custom-built hand-held probe. Both source and detector end of system are connected to frequency synthesizers for acquiring phase shifted signal. The detail of this optical imager can be found elsewhere [4,5].

B. Phantom studies

A transparent acrylic container filled with 1% Liposyn solution (volume of 10×6.5×10 cm^3) was used as tissue phantom (see Fig 1b). A hollow clear plastic sphere (volume of 0.45cm^3) filled with 1μM Indocyanine green dye (ICG) in 1% Liposyn solution was used to mimic a single target (or tumor). The phantom studies were performed at different target depth, size, number and target/background ICG contrast ratio as described in Table 1.

Table 1 Target details for extensive phantom studies

Experimental cases	Target volume (cm^3)	Target depth (cm)	Number of targets	Contrast ratio
Case 1-22	0.10~0.45	1.5~3	1~3	1:0
Case 22-44	0.45	1~2.5	1	1000:1~5:1

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