

LUAY FRAIWAN

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Department of Biomedical Engineering

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PROFESSIONAL PROFILE

Accomplished career demonstrating motivated and talented biomedical engineering professor driven to inspire students to pursue academic and personal excellence. Outstanding academic skills as demonstrated in creating a challenging and engaging learning environment in which students became lifelong learners and scholars. Academic service that contributed to the well establishment and ABET accreditation of the biomedical engineering department; including being department chairperson, head of the new curriculum committee which lead to ABET accreditation, teaching and planning several biomedical engineering courses, and being a resourceful academic advisor. Excellence in planning, organizational and negotiation strengths. Solid research experience (there is no graduate program at the BME Department) in the field of biomedical signal processing and therapeutic ultrasound demonstrated through several high quality publications in prestigious Journals including: Computer Methods and Programs in Biomedicine, Methods of Information in medicine, Medical and Biological Computing and Engineering (noting that there is no graduate program at the BME department and Jordan is country with very limited resources). Reviewer for several Journals such as: Biomedical Signal Processing and Control, Computer Methods and Programs in Biomedicine, IEEE Trans. On Biomedical Engineering. Also, a reviewer for several local and regional entities. Beside academic services, several community services were done including: consultant for the United State International Development Agency (USAID) for the health services strengthening; organizing several visits to refugees camps, participation in the Jordanian Engineering Society activities, and collaboration with biomedical engineering entities in Jordan. Currently on leave to Abu Dhabi University, United Arab Emirates, working on the foundation and accreditation of a new biomedical engineering program along with teaching responsibilities.

EDUCATION

2002 – 2005	Ph.D., Biomedical Engineering The University of Akron	Akron, OH, USA
2000 – 2002	M.S., Biomedical Engineering The University of Akron	Akron, OH, USA
1994-1995	Master in Medical Imaging Universite de Technologie de Compiegne	Compiegne, France
1988 – 1993	B.Sc., Electrical Engineering Jordan University of Science and Technology	Irbid, Jordan

RESEARCH INTERESTS

- Biomedical Digital Signal Processing
- Therapeutic Ultrasound
- Biomedical Instrumentation
- Clinical Engineering

PROFESSIONAL EXPERIENCE

- Sept, 2011-Aug. 2013 **Chairperson**, Department of Biomedical Engineering, *Jordan University of Science & Technology*,
Irbid, Jordan
- Aug, 2015-Present **Associate Professor** (Department of Electrical and Computer Engineering (**ABET** Accredited Dep.t), *Abu Dhabi University*,
Abu Dhabi, United Arab Emirates
- Aug, 2010-Present **Associate Professor** (Department of Biomedical Engineering (**ABET** Accredited Dep.t), *Jordan University of Science & Technology*,
Irbid, Jordan
- Aug, 2005-Aug, 2010 **Assistant Professor** (Department of Biomedical Engineering (**ABET** Accredited Dep.t), *Jordan University of Science & Technology*,
Irbid, Jordan
- Feb, 2006-Present **Biomedical Equipment Consultant**, Abt. Associates, United State Agency for International Development (USAID).
- Aug. 1995-Aug. 2000 **Biomedical Equipment Engineer**, King Abdullah Teaching Hospital Project (683 Beds).
College of Medicine, Jordan University of Science & Technology
Irbid, Jordan

PUBLICATIONS

- **Luay Fraiwan**, Mohanad AlKhodari, Jolu Ninan , Basil Mustafa, Adel Saleh, and Mohammed Ghazal, “Diabetic Foot Ulcer Mobile Detection System Using Smart Phone Thermal Camera: A Feasibility study”, Biomedical Engineering online, Accepted for publication, August 2017.
- **Fraiwan L.**, Khnouf R., and Mashagbeh A. "Parkinson's Disease Hand Tremor Detection System for Mobile Application”, Journal of Medical Engineering and Technology, Vol. 40 (3), pp. 127-134, 2016.
- **Luay Fraiwan**, “Predicting Preterm Delivery Based on Wavelet Packet Analysis of a Single Electrohysterography Channel”, Journal of Medical Imaging and Health Informatics, Vol 6 (6), pp. 1419-1425, 2016.
- **Fraiwan L.**, Lweesy K., Khasawneh N., Fraiwan M., Wenz H., and Dickhaus H., " Automated sleep stage identification system based on time-frequency analysis of a single EEG recording and random forest classifier", Computer Methods and Programs in Biomedicine, Vol. 108: 10-19; 2012. (Impact factor 2011: 1.5).

- **Fraiwan L.**, Lweesy K., Al-Nemrawi A., Dabbas S., and Saifan R., "Voiceless Arabic Vowels Recognition Using Facial EMG," *Medical and Biological Engineering and Computing* Vol. 49: 811-818, 2011. (*Impact factor 2010: 1.76*).
- **Fraiwan L.**, Lweesy K., Khasawneh N., Fraiwan M., Wenz H., and Dickhaus H., "Classification of sleep stages using multi-wavelet time frequency entropy and linear discriminant analysis," *Methods of Information in Medicine*, Vol. 49, No. 3: 230-237, 2010. (*impact factor 2009: 1.69*).
- **Fraiwan L.**, Lweesy K., Khasawneh N., Fraiwan M., Wenz H., and Dickhaus H., "Time frequency analysis for automated sleep stage identification in fullterm and preterm neonates," *Journal of Medical Systems* Vol. 35, No. 4: 693-702, 2011. (*Impact factor: 0.65*).
- **Fraiwan L.**, Lweesy K., Owies R., Al- Qubaln H, and AL-Hasanat M., "Medical waste management practices in Southern Jordan," *International Journal of Environmental and Waste Management*, Vol. 11, No. 3: 255-266, 2013.
- **Fraiwan L.**, Al-Bataineh O., Matouq J., Haddad S., and Bani-Amer M., "ECG-based wireless home infant apnoea monitor," *Journal of Medical Engineering and Technology*; 33(4):309-13, 2009. (*Impact factor: 0.63*).
- **Fraiwan L.**, Lweesy K., Oweis R., and Batineh O., "Book chapter: Medical Waste Management", *Handbook of Environment and Waste Management Volume 1: Chapter 23*. World Scientific Publishing Co. Pte. Ltd, Scheduled Winter, 2012.
- Khasawneh N., Conard S., **Fraiwan L.**, Taqieddin E., Khasawneh B., "Combining decision tree classifiers: a case study of automatic sleep stage scoring". *Int. J. knowledge Engineering and Data Mining*, Vol. 2, No. 1: 60-75, 2012.
- OM Al-Bataineh, K Lweesy, **L Fraiwan**, "Noninvasive transdermal insulin delivery using piston-shaped PZT transducers: in vivo rabbits evaluation", *Jourdanian Journal of Mechamcnical and Industrial Engineering JJMIE*, Vol 6 (1): 11-16, 2012
- Khasawneh N., Jaradat M., **Fraiwan L.**, and Al-Fandi M., "Adaptive Neuro-Fuzzy Inference System for Automatic Sleep Multistage Level Scoring Employing EEG, EOG, and EMG Extracted Features". *Applied Artificial Intelcegen*, 25: 163-179, 2011. (*Impact factor: 0.96*).
- OM Al-Bataineh, K Lweesy, **L Fraiwan**, "In-vivo evaluation of a noninvasive transdermal insulin delivery system utilizing ultrasound transducers, *Journal of Medical Imaging and Health Informatics*, Vol: 1 (3): 267-270, 2011
- Lweesy K., **Fraiwan L.**, Shalabi M., Mohammad L., and Ogla R., " Feasability Study of non-invasive Tumor Treatment with Focused Ultrasound," *Journal of Medical and Biological Engineering*, Vol. 30, No. (5), 321-328, 2010.
- Lweesy K., **Fraiwan L.**, Bataineh O., Hamdi N., and Deckhaus H., "Optimization of ultrasound array designs for high intensity focused treatment of prostate cancer and begnin prostetic hyperplasia," *Medical & Biological Engineering & Computing*, 47 (6), 635-640, 2009. (*Impact factor 2009: 1.76*).

- Lweesy K, **Fraiwan L.**, Khasawneh N., and Dickhaus H., "New automated detection method of OSA based on artificial neural networks using P-wave shape and time changes", Journal of Medical Systems, Vol. 35, No. 4: 723-734, 2011. (*Impact factor 2009: 0.65*).
- Lweesy K, **Fraiwan L.**, Shatat A., Abdo G., Dawodiah A., and Sameer M., "Design and evaluation of a HIFU transducer and 3D positioner with some preliminary ablation results in ex vivo kidney," Medical & Biological Engineering & Computing. 48 (3), 269-276, 2010. (*Impact factor 2009: 1.76*).
- Khasawneh N., Conrad S., **Fraiwan L.**, Taquieddin E., and Kasawneh B., " Combining Decsicion Trees : A Case Study of Automatic Sleep Stage Scoring," International Journal of Knowledge Engineering and Data Mining (IJKEDM), Vol: 2(1):60-75.
- Giakos G. , Medithe A., Sumrain S., Sukumar S., **L. Fraiwan**, and A. Orozco, "Laser Polarimetric Imaging of Surface Defects of Semiconductor Wafers, Microelectronics, and Spacecraft Structures," IEEE Transactions on Instrumentation and Measurement, 55(6):2126-2131, 2006. (*Impact factor: 0.98*).
- Giakos G., Sukumar S., Valluru K., Bathini P., Paturi S., Ambadipudi K., Wagenar D., Adya V., Reddy M., **Fraiwan L.**, and Sheffer D., "Increased Visibility of Targets Submerged in Scattering Opaque Media and Polarimetric Technique," IEEE Transactions On Instrumentation and Measurements, Vol. 57, No.12, Dec. 2008, pages: 2777-2781. (*Impact factor: 0.98*).
- Giakos G., Patnekar N., Sumrain S., **Fraiwan L.**, and Kumar V., "A Novel Multipath Light Signal Dispersion Reduction Technique Based on Controlled-Polarization Optical Wireless Link Setup", IEEE Transactions On Instrumentation and Measurements, Vol. 54, No.5, Oct. 2005, pages: 1950-1956. (*Impact factor: 0.98*).
- Joan Carletta, **Luay Fraiwan** et. al., "Design of Field Programmable Gate Arrays-Based Platform for Real-Time De-noising of Optical Imaging Signals Using Wavelet Transform," Elsevier, Measurement, Vol. 36, pp. 289-296, 2004. (*Impact factor: 0.93*).
- George Giakos, **Luay Fraiwan** et. al., "A Sensitive Optical Polarimetric Imaging Technique for Surface Defects Detection of Aircraft Turbines Engines," IEEE Transactions on Instrumentation and Measurement, Vol. 53, No. 1, pp. 216-222, Feb. 2004(*Impact factor: 0.98*).
- George Giakos, **Luay Fraiwan** et. al., "Signal Dispersion Measurements on the Gas Detector Volume of a Dual-Energy Multimedia Digital Imaging Sensor," IEEE Transactions on Instrumentation and Measurement, Vol. 52, No. 5, pp. 1566-1572, 2003 (*Impact factor: 0.98*).
- George Giakos, **Luay Fraiwan** et. al., "Signal Evaluation of a Novel Dual-Energy Multimedia Imaging Sensor," IEEE Transactions on Instrumentation and Measurement, Vol. 51, No. 5, pp. 949-954, 2002 (*Impact factor: 0.98*).
- George C. Giakos, **Luay Fraiwan** et. al., "A Novel Multipath Dispersion Reduction Technique Based on Polarization Optical Wireless Link Setup," Proc. IEEE Instrumentation and Measurements Technology Conference, Vol. 2, pp. 1622-1626, Anchorage, AK, May, 2003

- George C. Giakos, **Luay Fraiwan** et. al., “An Optical Polarimetric System for Surface Defect Detection of Aircraft Engines”, Proc. IEEE Instrumentation and Measurements Technology Conference, pp. 1701-1704, Anchorage, AK, 2002
- George C. Giakos, **Luay Fraiwan** et. al., “Signal Parameter Enhancement of an Optical Wireless System Utilizing Wavelet Transform”, Proc. IEEE Instrumentation and Measurements Technology Conference, pp. 953-956, Anchorage, AK, 2002
- George C. Giakos, **Luay Fraiwan** et. al., “Optimization of an Optical Wireless System”, Proc. IMEKO, Proc. of International Measurements Confederation, Lisbon, Portugal, September 2001.
- George C. Giakos, **Luay Fraiwan** et. al., “Signal-to-Noise Ratio Improvement of an Optical Wireless Indoor System Utilizing Wavelet Transforms”, Proc. IEEE Instrumentation and Measurements Technology Conference, pp. 953-956, Anchorage, AK, 2002
- **Luay Fraiwan**, “An Improved Electrical Impedance Tomography System,” Doctoral Dissertation, Department of Biomedical Engineering, The University of Akron, Akron, OH, August 2005
- **Luay Fraiwan**, “An Efficient Technique for A high Reflectivity Polarimetric Imaging System with Real Time Denoising”, Masters Thesis, Department of Biomedical Engineering, The University of Akron, Akron, OH, August 2002

CONFERENCES

- **Luay Fraiwan** and Khaldon Lweesy " Neonatal Sleep State Identification Using Deep Learning Autoencoders", 2017 IEEE 13th International Colloquium on Signal Processing & Its Applications (CSPA 2017), Penang Malaysia, pp. 231-234..
- **Luay Fraiwan** and Khaldon Lweesy "Newborn sleep stage identification using multiscale entropy" *Proceeding of the second Middle East Conference on Biomedical Engineering (MECBME'11), Doha, Qatar, Feb. 17-20, 2014.*
- **Luay Fraiwan**, Mohammed Awwad, Ma'en Mahdawi, and Shaher Jamous, "REAL TIME VIRTUAL PROSTHETIC HAND CONTROLLED USING EMG SIGNALS," *Proceeding of the first Middle East Conference on Biomedical Engineering (MECBME'11), Sharjah, UAE, Feb. 21-24, 2011.*
- **Luay Fraiwan**, Khaldon Lweesy, Aya Bani-Salma, and Nour Mani, "A wireless home safety gas leakage detection system," *Proceeding of the first Middle East Conference on Biomedical Engineering (MECBME'11), Sharjah, UAE, Feb. 21-24, 2011.*
- Osama Al-Batineh, Khaldon Lweesy, **and Luay Fraiwan**, "Noninvasive Transdermal Insulin Delivery Using Ultrasound Transducers," *Proceeding of the first Middle East Conference on Biomedical Engineering (MECBME'11), Sharjah, UAE, Feb. 21-24, 2011.*
- **Fraiwan L.**, Kasawneh N., and Lweesy K., "Automatic Sleep Stage Scoring with Wavelet Packets Based on Single EEG Recording," *Proceedings of the International Conference of Medical Informatics and Biomedical Engineering, Waset: ICMIBE-Paris 2009, Vol. 54, pp. 513-516.*

- Lweesy K., **Fraiwan L.**, Shatat A., Abdo G., Dawodiah A., and Sameer M., "Design and Evaluation of a Three Dimensional Ultrasound System for Tissue Ablation for Treatment of Kidney Tumors," *Proceeding of the 25th Southern Biomedical Engineering Conference 2009, 15 – 17 May 2009, Miami, Florida, USA*
- Lweesy K., **Fraiwan L.**, Maier C., and Dickhaus H., "Extraction of fetal heart rate and fetal heart rate variability from mother's ECG signal," *Paris 2009 International Conference on Medical Informatics and Biomedical Engineering*, Paris, France, 24-26 June 2009.
- Lweesy K., **Fraiwan L.**, Al-Shalabi M., Mohammad L., and Al-Oglah R., "Design and ex vivo evaluation of a 3D high intensity focused ultrasound system for tumor treatment with tissue ablation," *IFMBE Proceedings of the 26th Southern Biomedical Engineering Conference*, College Park, MD, USA, 2010, Vol. 25.
- Lweesy K., **Fraiwan L.**, Hadarees D., Jamil A., and Ramadan E., "Design, construction, and evaluation of an electrical impedance myograph," *IFMBE Proceedings of the 26th Southern Biomedical Engineering Conference*, College Park, MD, USA, 2010, Vol. 25.
- Lweesy K., **Fraiwan L.**, Maier C., and Dickhaus H., "Extraction of fetal heart rate and fetal heart rate variability from mother's ECG signal," *Proceedings of the International Conference of Medical Informatics and Biomedical Engineering*, Waset: ICMIBE-Paris 2009, Vol. 54, pp. 704-708.
- Lweesy K., **Fraiwan L.**, Shatat A., Abdo G., Dawodiah A., and Sameer M., "Design and Evaluation of a Three Dimensional Ultrasound System for Tissue Ablation for Treatment of Kidney Tumors," *IFMBE Proceedings of the 25th Southern Biomedical Engineering Conference*, Miami, FL, USA, 2009, Vol. 24, pp. 19-20.

AWARDS AND GRANTS

- **Research Fund:** A wireless outdoor measurement device of human joint angle using inertia sensors, 2016, Abu Dhabi University Fund.
- **Research Fund:** Automated sleep stage identification using deep learning techniques and tunable Q-factor wavelets, 2016, Abu Dhabi University Fund.
- **Sabbatical Leave** 2015/2016, Abu Dhabi University, United Arab Emirates.
- **Hisham Hijawii Award** for applied sciences for best research in the field of Technology and communications, 2010.
- **Funded Research Visits** (2009, 2010) Two research visits to the **University of Heidelberg/Germany** funded by the German Research Foundation (**Deutsche Forschungsgemeinschaft – DFG**)
- **Research Fund:** Design and Evaluation of Multi-frequency ultrasound system for transdermal ultrasound-mediated non-invasive insulin delivery, **The Scientific Research Support Fund**, 2009.
- **Research Fund:** Research and development of practical applications for kinetic sensor kit, Faculty of Scientific Research, Jordan University of Science and Technology.
- **Research Fund:** Enhanced Electrical Impedance Reconstruction System, Faculty of Scientific Research, Jordan University of Science and Technology.

- **Judge, Think Science, Emirates Foundation.**
- **Outstanding Graduate Student** in Biomedical Engineering Award 2005, Department of Biomedical Engineering at The University of Akron.
- **Doctoral and Master** Scholarships from Jordan University of Science and Technology to obtain the Ph.D degree in Biomedical Engineering from the University of Akron (2000–2005).
- **Full Time Teaching Assistantship** for the Ph.D., The University of Akron.
- **Full Time Research Assistantship** for the M.S., The University of Akron.
- **Scholarship for Master’s Degree**, The Universite de Technologie de Compiegne, France.
- Represented JUST in a **TEMPUS** project that contributed to the establishment of a new Biomedical Engineering Department at Yarmouk University, Irbid, Jordan.

SERVICES

Academic Services:

- **ABET** Accreditation Committee
- Head of BME Department Research Committee
- College of Engineering Research Committee
- BME Curriculum chairman (the new curriculum 2013)
- BME Department Council
- Engineering Faculty Council
- BME Practical Training Committee

Community Services:

- Consultant, medical equipment, United state International Developments Agency (USAID), Helath Service Strengthening Mission (HSS), 2006-2014
- Delivering the following workshops:
 - Magnetic Resonance Imaging (MRI)
 - Training of Trainers (TOT)
- Ministry of Higher Education Reseach Fund, Higher Technical Committee
- National Accredation Committee, Biomedical Engineering
- Community outreach committee
- Represented JUST in a TEMPUS project that led to the establishment of a new Biomedical Engineering Department at Yarmouk University, Irbid, Jordan.

TEACHING

- Medical Imaging Systems
- Biomedical Signals and Systems
- Digital Signal Processing
- Biomedical Instrumentation
- Biomedical Instrumentation Lab
- Digital Image Processing
- Biomedical Electronics II

- Biomedical System Analysis
- Biomedical Transport
- Biostatistics
- Special Topics: Wavelets in Biomedical Signal and Image Processing
- Engineering Training
- Seminar in Biomedical Engineering
- Graduation Project I
- Graduation Project II

SUPERVISED SENIOR DESIGN PROJECTS

-
- Vibrography (VMG) and Electromyography
- Portable ECG Recorder with Bluetooth Interface
- Design of Classification System for Lung diseases
- Arabic Vowels Recognition using Facial Electromyography
- Wireless MMG
- Survey of Neonatal Units in Hashemite Kingdom of Jordan
- Real Time USB ECG/Photoplethysmography with Remote Connectivity
- Wireless Home Gas-Leakage Detector
- Medical Waste in the Jordanian Private Hospitals
- Design of Bluetooth Home Apnea Detection system
- Real Time USB ECG/Photoplethysmography with Remote Connectivity (2)
- Wireless VMG (Vibrogram)
- Hospital Management of Administrated Maintenance (HMAM)
- Building a Signal Monitor System (ECG) acquiring from DAQ and Building networking system for sending it by TCP/UDP Protocol from Server to Client Using Labview Software
- Mobile Dental Treatment Unit
- Volume Visualization using Visualization Toolkit (vtk)
- Apnea Monitoring
- Design of a Wireless Home Apnea Detection and Treatment system
- Design and Evaluation of a 3D high intensity Focused Ultrasound System for the Treatment of Kidney Tumors
- A Focused Signal Element Ultrasound Transducer to Treat Breast Cancer
- High Intensity Focused Ultrasound for Breast Therapy
- Dual Channel Electronic Stethoscope

COMPUTER SKILLS

- Packages: Matlab-Simulink,, Mathcad, LabView, MS-Office, SAS and Minitab
- Finite Element Software: I-DEAS and Abaqus
- Languages: Visual Basic and C
- Operating Systems: Windows-XP

LANGUAGES

- **English** - excellent (written and spoken)

- **Arabic** - excellent (written and spoken)

REFERENCES

Furnished upon request