

# LUAY FRAIWAN

Jordan University of Science & Technology  
Department of Biomedical Engineering  
P.O. Box 3030  
Irbid 22110, Jordan  
PHONE +962-79-5655116  
E-MAIL: [fraiwan@just.edu.jo](mailto:fraiwan@just.edu.jo)

## EDUCATION

---

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

## RESEARCH INTERESTS

---

- Biomedical Signal Processing
- Medical Imaging
- Biomedical Instrumentation
- Clinical Engineering

## PROFESSIONAL EXPERIENCE

---

Sep. 2011-Present	<b>Chairperson</b> , Department of Biomedical Engineering, <i>Jordan University of Science &amp; Technology.</i> <i>Irbid, Jordan</i>
Aug, 2010-Present	<b>Associate Professor</b> (Department of Biomedical Engineering ( <b>ABET</b> Accredited Program), <i>Jordan University of Science &amp; Technology.</i> <i>Irbid, Jordan</i>
Aug, 2005-Aug, 2010	<b>Assistant Professor</b> (Department of Biomedical Engineering ( <b>ABET</b> Accredited Program), <i>Jordan University of Science &amp; Technology.</i> <i>Irbid, Jordan</i>
2006-Present	<b>Consultant</b> , Medical Equipment Procurment, HSS Project, <i>Abt Associates Inc.-USAID</i> <i>Amman-Jordan</i>
Aug. 1995-Aug. 2000	<b>Biomedical Equipment Engineer</b> , King Abdullah Teaching Hospital Project (683 Beds). <i>College of Medicine, Jordan University of Science &amp; Technology</i> <i>Irbid, Jordan</i>

## PUBLICATIONS

---

- **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*, 2011. Accepted for publication, DOI: :10.1016/j.cmpb.2011.11.005
- **Fraiwan L.**, Lweesy K., Al-Nemrawi A., Dabbas S., and Saifan R., "Voiceless Arabic Vowels Recognition Using EMG," *Medical and Biological Engineering and Computing* Vol. No. 7: 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*, Accepted for publication, 2009.
- **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.
- 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 Intelligence*, 25: 163-179, 2011. (*Impact factor: 0.96*).
- 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 beginin 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 Decision Trees : A Case Study of Automatic Sleep Stage Scoring," International Journal of Knowledge Engineering and Data Mining (IJKEDM), Accepted for Publication, 2010.
- 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**, 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 25<sup>th</sup> 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 26<sup>th</sup> 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 myographer,” *IFMBE Proceedings of the 26<sup>th</sup> 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 25<sup>th</sup> Southern Biomedical Engineering Conference*, Miami, FL, USA, 2009, Vol. 24, pp. 19-20.

## TEACHING

---

- Biomedical Instrumentation
- Digital Image Processing
- Biomedical Electronics II
- Biomedical System Analysis
- Biomedical Transport
- Biomedical Instrumentation Lab
- Biomedical Signals and Systems
- 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

#### WORKSHOPS (DELIVERED)

---

- Magnetic Resonance Imaging
- Training of Trainers

#### 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

#### COMMITTEE MEMBERSHIP

---

Served as a member of various scientific and educational councils and committees:

- BME Department Council
- Engineering Faculty Council
- ABET Accreditation Committee
- BME Curriculum Committee
- Community Outreach Committee
- BME Practical Training Committee

#### LEADERSHIP ACTIVITIES AND AWARDS

---

- **Hisham Hijawii Award** for applied sciences for best research in the field of Technology and communications, 2010.
- Two Summer research visits to the **University of Heidelberg/Germany** funded by the German Research Foundation (Deutsche Forschungsgemeinschaft – **DFG**)

- **Outstanding 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.
- Member of the BME department ABET committee which led to obtaining the ABET accreditation.
- Respresented JUST in a TEMPUS project that led to the establishment of a new Biomedical Engineering Department at Yarmouk University, Irbid, Jordan.

#### LANGUAGES

---

- **English** - excellent written and spoken
- **Arabic** - excellent written and spoken

#### REFERENCES

---

- Prof. Sabry Hamaza, Deputy Chief of Party, Safe Motherhood Team Leader, Health Systems Strengthening (USAID), E-mail: [sabry.hamza@hss.jo](mailto:sabry.hamza@hss.jo)
- Prof. Omar Al-Jarah, Vice President, Jordan University of Science and Technology, E-mail: [aljarrah@just.edu.jo](mailto:aljarrah@just.edu.jo)
- Prof. Mousa Abu Arabi, Dean College of Engineering, Jordan University of Science and Technology, E-mail: [mousa@just.edu.jo](mailto:mousa@just.edu.jo)