

# Abdullah M. Al-Refai, Ph.D.

IEEE Member

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## Contacts

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## Summary:

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Abdullah Al-Refai, Ph.D. is currently an Assistant Professor in the Department of Software Engineering at Princess Sumaya University for Technology (PSUT). Dr. Al-Refai has worked in the Automotive Industry. He worked as a Senior Controls Software Engineer in the Powertrain Controls Department at Fiat Chrysler Automobiles, Michigan USA. He received his Ph.D. in Electrical and Computer Engineering from Oakland University in 2018 after obtaining his Master's in Electrical and Computer Engineering from the same university in 2012. He received his Bachelor's in Computer Engineering from Yarmouk University (Irbid, Jordan) in 2010. He worked as a research assistant in the Chrysler Lab and in the Embedded Systems Lab at Oakland University as well as a teacher assistant of a course in a Design and Analysis of Electromechanical Systems. He had two internships, one in EMC testing at Continental Automotive Company in 2012, and the other in Java programming at Petra Solar Company in 2009. He served as the president of Aerial System Club at Oakland University which successfully competed in the Collegiate Aerial Robotics Demonstration (CARD) Competition, St. Louis, MO April 2011. The team ranked 2nd place and won the "Aerial Vehicle Innovative Design Award".

Dr. Abdullah has extensive experience in Software Engineering, embedded systems design, control algorithm design, and software development with applications related to Gasoline Engine Controls and Intelligent Battery Sensor Diagnostics. His main research areas are artificial intelligence, Lithium-Ion Batteries Models, Lithium-Ion Batteries Charging Methods, embedded systems, control systems, robotics, and UAV development.

## Education

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- **Oakland University**, Rochester Hills, MI, USA Jan, 2012 – April, 2018  
Ph.D. in **Computer Engineering**  
*Dissertation: "Development of a Temperature and I-V Performance Model for Lithium-Ion Polymer Batteries"*
- **Oakland University**, Rochester Hills, MI, USA Jan, 2010 – Dec, 2011  
Master in **Computer Engineering**
- **Yarmouk University**, Irbid, Jordan Sep, 2005 – Dec, 2009  
B.Sc. in **Computer Engineering**

## Strengths:

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- **Programming:** Matlab, Assembly, C/C++, Visual Basic, Java (Servlet, Apache Tomcat), C# (Windows Mobile 6 Professional), MySQL.
- **Microprocessors / Microcontrollers:** Freescale: HCS11 and HCS12, Microchip: dsPIC30F family, Cypress: PSoc, Microchip: dsPIC30F, and Intel: 8085, and 8086.
- **Communication Protocols:** SPI, SCI, I2C, TCP/IP, Zigbee, CAN, LIN and USB.

- **Software Tools:** Matlab Simulink, Matlab Targetlink, Matlab State flow, PSpice, Code Write, Freescale CodeWarrior, Cypress PSoC Programmer, Provetech., ETAS INCA, and ETAS EHOOKS.
- **Data Acquisition:** NI USB-6008 DAQ systems, I-Box.
- Strong logical and analytical skills.
- Outstanding written and verbal skills.
- Ability to work in a group environment.
- Understanding of essential automotive terms.
- Ability to work in a fast-paced environment.
- Strong background in mathematics and physics.

## Academic and Industrial Experience:

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**Princess Sumaya University for Technology, Amman, Jordan**  
**Assistant Professor of Software Engineering**

**09/2020 – Present**

### Highlights:

- Joined PSUT as an Assistant Professor of Software Engineering at the King Hussein School of Computing Sciences on September, 2020.
- Teaching: Taught various Software Engineering classes such as the Introduction to Software Engineering, System Analysis and Design, and the Introduction to Computer Science courses.

**Al-Ahliyya Amman University, Amman, Jordan**  
**Assistant Professor of Computer Engineering**

**08/2019 – 08/2020**

### Highlights:

- Joined AAU as an Assistant Professor of Computer Engineering at the School of Engineering on August, 2019.
- Lead the department's ABET accreditation committee which planned in receiving ABET accreditation for the Computer Engineering Program.
- Participates in the establishment of all academic and non-academic policies and procedures.
- Teaching: Taught various Computer Engineering classes such as Algorithms, Selected Topics in Computer Engineering (Arduino), Computer Skills (C++), Computer Organization and Design, and Technical Writing courses.
- Research: Artificial intelligence, robotics, and Lithium-Ion Batteries Models.

**Fiat Chrysler Automobiles, Auburn Hills, MI**  
**Senior Controls Software Engineer**  
**On-Board Diagnostics Development Team**

**08/2016 – 08/2019**

### Highlights:

- He is working as a Senior Controls Software Engineer for the Powertrain Department as part of the On-Board diagnostics development team.
- His job responsibilities are analysing, designing, controlling, developing algorithms, and implementing software to meet high level/functional requirements within program timelines. He is also responsible for defining on-board diagnostics test procedures for all OBD fault codes of current/next-generation powertrains of FCA vehicles that must be verified per the California Air Resources Board OBD Regulations.
- Control algorithm development is done using Matlab-Simulink and rapid prototyping tools.
- Product software development tools that were used to design and implement a new OBD diagnostic:
  - Matlab-Simulink, Matlab-TargetLink, Data Dictionary, and Code Write.

- Programming languages were used to implement new features: C and C++.
- These tools are used to develop algorithms and follow its development through implementing production software, such as the development of all supporting documentation (including DFMEA, testing and validation reports) and calibration guides.
- This work is performed in the vehicle, dynamometer and/or simulator environments (Hardware in the Loop).
- He is the feature team leader for the following diagnostics:
  - Intelligent Battery Sensor Battery Temperature Rationality
  - Intelligent Battery Sensor Communications Diagnostics
  - Intelligent Battery Sensor State of Charge Rationality
  - Intelligent Battery Sensor Voltage and Current Diagnosis

**Fiat Chrysler Automobiles, Auburn Hills, MI**

**04/2014 – 08/2016**

**Production Development Engineer**

**Sensor and Actuator Feature Team**

**Highlights:**

- Responsible for analysing, designing, developing, and maintaining software of the sensors and actuators systems.
- Product development tools that were used to implement a new feature are:
  - Matlab-TargetLink, Data Dictionary, and Code Write.
- Programming languages were used to implement new feature: C and C++.
- Product diagnostic tools that were used to test new features are:
  - HIL, INCA, and NGC Tools.

**Chrysler Lab at Oakland University, Rochester Hills MI**

**10/2012 –04/2014**

**Research Assistant**

**Fuel Economy Correlation Project**

**Highlights:**

- Using Chrysler's HIL at Oakland University in a Fuel economy correlation project.
- Simulating FTP drive cycle (City cycle and highway) using HIL-Provetech software.
- Collecting experimental data from a vehicle.
- Analysing Simulation data for correlation with experimental vehicle data.

**Oakland University, Rochester Hills MI**

**09/2010 – 04/2014**

**Teacher Assistant**

**Highlights:**

- Lab instructor of a course on Design and Analysis of Electromechanical Systems: Supervising the lab sessions, helping students with their projects, and participating in grading and evaluating the students.
- This course focused on designing, analysing, and testing electromechanical systems; statics, linear and rotational dynamics; introduction to microprocessors; team design project dealing with technical, economic, safety, environmental, and social aspects of a real-world engineering problem; written, oral, and visual communication, engineering ethics.

**Oakland University, Rochester Hills MI**

**01/2012 – 04/2018**

**Research Assistant**

**Study: Development of a Temperature and I-V Performance Model for Lithium-Ion Polymer Batteries Research**

**Highlights:**

- The purpose of this study is to develop a combined battery model that incorporates cell voltage and temperature for more accurate/efficient charging of Li-Ion Polymer batteries.
- A dynamic programmable charger was designed to implement and evaluate different charging algorithms.
- The Constant Current-Constant Voltage, Multistage Constant Current, and Constant Current Pulse charging methods of Lithium-Ion Polymer batteries were implemented by using this charger for experimental studies and analysis.
- These three traditional charging methods were experimentally evaluated and compared.
- The Chen and Mora's model and Al Hallaj's model were implemented and experimentally evaluated for three different traditional charging models. In this work, these models were used in order to provide the temperature estimation of Lithium-Ion Polymer batteries during the battery charging cycle.
- This work developed a combined battery model of Lithium-Ion Polymer batteries that included most of the significant battery parameters such as
  - Cell Voltage
  - Cell Temperature
  - Charging Current
  - SOC
  - Battery impedance
- The combined model was implemented and experimentally evaluated for three different traditional charging models.
- This combined model is necessary to design more accurate and efficient charging techniques of Lithium-Ion Polymer batteries.
- This work is one of the first to study and provide a model for battery cell voltage and temperature based on using only charging current as input.

**Continental Automotive Company, Auburn Hills MI**  
**Electrical Engineering Internship**

**07/2011 – 01/2012**

**Highlights:**

- Performing EMC tests and maintaining records of all the compliance testing
- Timely, accurate, and precise reporting of the data to the design teams.
- Communicating and interfacing with other associates and EMC experts while sharing information and experiences.
- Using CANoe and Engine simulator to perform EMC tests.
- Managing to upload project documents by using SharePoint.

**Oakland University, Rochester Hills MI**  
**Research Assistant**  
**GPS Receiver and Antenna Testing Project**

**07/2012 –09/2012**

**Highlights:**

- Testing different antenna types that were connected to various locations in a car. These antennas were connected to GPS receivers.
- Collecting experimental data from Mini-Van and Sedan cars.
- Recording the GPS data using the U-Center software.

**Oakland University, Rochester Hills MI**  
**Research Assistant**  
**Ultra low RPM motor**

**01/2011 –07/2011**

**Highlights:**

- Developing an ultra-low RPM motor using NiTiNol actuators to be used for cell culture cultivation in medical research labs. In order to generate rotation, the shrinking feature of NiTiNol wire was used.
- Attaching five of NiTiNol wires with the angle of  $72^\circ$  on a bearing on disc.
- Calculating the accurate timing and pulling force for each wire.
- Designing the PID control algorithm and implementing the code to rotate the motor in a uniform rotational speed.
- Controlling the system by using a Matlab-Simulink, NI DAQ, and Freescale HCS12 16 bit microcontroller.

**Oakland University, Rochester Hills MI**

**03/2011 - 04/ 2011**

**Research Assistant**

**Feedback Control of a Rotary Driven Inverted Pendulum**

**Highlights:**

- The objective of this project was to show that rotary encoders can be used as feedback sensors in a microcomputer-based control system to effectively balance the Pendulum in an upright position.
- Modeling and simulation with visualization of pendulum arms running in Simulink were used to design and test state space control before demonstrating it on a physical setup.
- Controlling balance in anti-sway position.

**Oakland University, Rochester Hills MI**

**03/2011 - 04/ 2011**

**Research Assistant**

**Graceful Degradation in Faulty System using checkpoints**

**Highlights:**

- The goal of this project was to demonstrate how a graceful degradation of multiple microcontrollers can be achieved.
- This project had four HCS12 microcontrollers that were connected on CAN bus network. The first microcontroller's duty was to perform critical tasks while the second microcontroller's job was non-critical. The third microcontroller's job was to store received check points, whereas the fourth microcontroller was connected to RC car lids.
- This project established how a graceful degradation can be achieved by stopping the non-critical task and running the critical task when a fault happens to the critical task executing microcontroller.
- Checking pointing allows resuming (not starting from scratch) the execution of the critical task by rolling back to a known valid state.

**Petra Solar Company Lab at University of Central Florida, Orlando FL**

**06/2009 - 12/2009**

**Programming Internship**

**Sun Wave System Installation Tool Developed software**

**Highlights:**

- Sun Wave System Installation tool was developed for handheld application that collects information about Sun wave System Installations, such as GPS information, pole ID, installation date and operator.
- The collected data can be synchronized, either online or offline to a Central Database Server.
- This data server is an essential resource for technical and management usage.

**Yarmouk University, Irbid, Jordan**

**02/2009 - 05/2009**

**Undergrad Final Project**

**Estimation of Damaged Isolation Using Image**

**Highlights:**

- Estimation of Damaged Isolation Using Image Processing was the final graduation project.

- The objective of this project was to determine the amount of damage that happened to the fiber optic insulators by using image processing field.

## Publications:

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### Journal Paper

- Mohammad Alhaj, Mohammad Hassan and **Abdullah Al-Refai**, “A New Approach for Multi-Level Evaluation of Strategic Educational Goals” International Journal of Advanced Computer Science and Applications(IJACSA), 11(3), 2020
- **Abdullah Al-Refai**, Rami Abou-Sleiman, and Osamah A. Rawashdeh, “An Experimental Survey of Li-Ion Battery Charging Methods”, SAE International Journal of Alternative Powertrains, August 21, 2015

### Conference Paper

- A. Saif, H. AL-KILANI, M. QASAIMAH, and **A. AL-REFAI**, “Analysis of Android Applications Permissions,” in International Conference on Data Science, E-Learning and Information Systems 2021, New York, NY, USA, 2021, pp. 243–249. doi: 10.1145/3460620.3460764.
- Rami Abou-Sleiman, **Abdullah Al-Refai**, and Osamah A. Rawashdeh, “Charge Capacity Versus Charge Time in CC-CV and Pulse Charging of Li-Ion Batteries”, SAE International Conference, April 08, 2012, Detroit, MI, USA.
- **Abdullah Al-Refai**, Rami Abou-Sleiman, and Osamah A. Rawashdeh, "A Programmable Charger for Monitoring and Control of Multi-Cell Lithium-Ion Batteries”, National Aerospace & Electronics Conference, July 25-27, 2012, Dayton, OH, USA.

### Journal Paper Ready for Submission

- **Abdullah Al-Refai**, Osamah A. Rawashdeh, Sami Oweis, and Meir Shillor, “Development of a Temperature and I-V Performance Model for Lithium-Ion Polymer Batteries”.

### Conference Poster

- **A. Refai**, M. Rawashdeh, O. Rawashdeh, J. Woolsey, A. Qatu, "Development of a Radial Nitinol Motor" 2011 ASEE North-Central & Illinois-Indiana Section Conference, Central Michigan University Mt. Pleasant, MI, USA, April 12, 2011.

## Awards:

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- The Provost’s Graduate Student Research Award, Oakland University, 2011.
- A medal for academic excellence in the undergraduate studies from Yarmouk University, 2005.

## Additional Information:

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- President of the Aerial Systems Club at Oakland University, where his team designed and developed a Quadrotor Unmanned Aerial Vehicle (UAV), which successfully competed at the CARD Collegiate Aerial Robotics Demonstration Competition, St. Louis, MO April 2011. He was placed the 2<sup>nd</sup> and won the “Aerial Vehicle Innovative Design Award”.
- MCSA Internationally certified.