Mohamed Fathy Badran

11B Zizinia compound Fifth Settlement , New Cairo, Egypt P.O. 11835
Tel (mobile): +2(011) 1110-6742; E-mail: mohamed.badran@gmail.com

Current Position:

Acting Chairman, Assistant Professor, Mechanical Engineering Department, Future University in Egypt, New Cairo, Egypt.

Education:

Ph.D. Engineering Systems & Computing, University of Guelph, Canada, **2010**
Biological Micro-Electro Mechanical Systems (BioMEMS)
"A Closed Loop System for Partial Restoration of Spinal Cord Reflex Function"

M.Sc. Mechanical Engineering, The American University in Cairo, Egypt, **2003**
Concentration: Industrial Engineering
"Optimization of Municipal Solid Waste Management in Port Said."

B.Sc. Mechanical Engineering, The American University in Cairo, Egypt, **2001**
Concentration: Industrial Engineering and Design. *Minor*: Electronics
Honors: Magna Cum Laude
"Design and Fabricate a lab Automated Guided Vehicle."

Academic and Professional interests:

- Operation Research and Optimization.
- Autonomous Vehicles
- Lower Limb Exoskeletons
- Modeling of BioMEMS sensors
- Micro-pumps for Biomedical applications
- Cardiovascular computational modeling
- Electrostatic Precipitators

Academic Employment:

Future University in Egypt, Cairo, Egypt	
Assistant Professor	Feb. 13- Current
Adjunct Faculty	Sep. 12- Dec. 12
The American University in Cairo, Cairo, Egypt	
Affiliate Adjunct Faculty / Adjunct Faculty	Sep. 10-Current
Visiting Assistant Professor	Jan.- Sep. 11 & Jan.- Sep. 12
British University in Egypt, Cairo, Egypt	
Adjunct Faculty	Oct. 10- Jan. 12
University of Guelph, Guelph, Ontario, Canada	
Graduate Teaching Assistant	Jan. 04-Apr. 10
Graduate Research Assistant	Sep. 03- Apr. 10

Professional Experience:

- **Teaching Experience**

  Future University in Egypt — Sep. 12- Current

  Undergraduate Courses:

- *Project Management (MAN 592)*
- *Engineering Economics (MAN 381)*
- *Mechatronics Design 1 (MKT 411)*
- *Mechanical Design 2 (MAN 441)*
- *Introduction to Micro-Electro-Mechanical Systems (MEMS) (MKT 507)*
- *Reverse Engineering in Mechanical Design (MAN 547)*
- *Dynamics of Rigid Bodies (MEC 221)*
- *Production Engineering 1 (MAN 221)*
- *Production Technology (MAN 121)*

The student evaluation average is very good.

The American University in Cairo — Sep. 10 – Current

Undergraduate Courses:

- *Mechanical Systems (MENG 3502)*
- *Engineering Mechanics II (Dynamics) (ENGR 2104)*
- *Engineering Mechanics (ENGR 2105)*
- *Engineering Economy (ENGR 3222)*
- *Engineering Analysis and Computation I (ENGR 3202)*
- *Fundamentals of Fluid Mechanics (ENGR 2122) Lab*

The student evaluation average for the undergraduate courses is 4.4 out of 5.
A sample of the students' comments was:
"Dr.Mohamed Badran is the best Professor I met in AUC, I never met a professor who is ready to help his students and being always available for office hours for any questions, he is concerned with making sure that the students understand this course and get the best out of it"

Graduate course:

- *Fabrication of Nano-materials for films and devices (NANO 5204)*

The student evaluation average for the graduate course is 4 out of 5.
A sample of the students' comments was:
"Dr. Badran was real awesome; He made the course very enjoyable for us. He was so encouraging and supportive for us that I can go and ask him for whatever I need. It was really nice taking the course with him."

The British University in Egypt — Oct. 10 – Jan. 12

- *Industrial Safety (ENGG04H03)*

University of Guelph — Jan. 04 – Apr. 10

- *Computerized Organization and Design (ENGG3380)*
- *Engineering Mechanics I (ENGG1210)*
- *Engineering Mechanics II (ENGG2160)*
- *Introductory Physics for Life Sciences (Phys1070)*
- *Physics for Life Sciences (Phys1080)*

- *Physics with Applications (Phys1130)*

The student evaluation average was 3.93 out of 5.
A sample of the students' comments was:
"Mohamed is an excellent TA. Not only is he knowledgeable and helpful, but he is very caring, and goes above and beyond a regular TA's duties. His dedication was very evident in the extra time he took to help students on those cold Monday nights from 7-9pm. I really appreciate all of his help, and would feel lucky to have him as a TA again!"

- **Research Experience**

Assistant Professor, Future University in Egypt Jan. 13-Current

- ***Material Handling Systems***
  The objective of this research is directed towards design and fabrication of Autonomous Guided Vehicle systems for solving material handling operations in different industrial applications setups and laboratory proof of concept prototypes. In these designs, different control systems for motion and steering are being employed.
- ***Obstacle Avoidance Wheel Chairs***
  The objective of this research is to design and fabricate autonomous obstacle avoidance powered wheel chairs for paraplegic patients. The motion of the chair will be triggered using a user input either in the form of a joy-stick or a voice commands. It can also maneuver to a predefined location.
- ***Non mechanical micropumps***
  The objective of this research is to design and simulate non mechanical micropumps such as electrohydrodynamic ion drag micropump or Electroosmotic micropumps for Lab on a chip application. In addition, the optimization of the geometric design parameters is a key requirement to develop an efficient micropump.

Adjunct Assistant Professor, American University in Cairo Sep.10-Current

- ***Assessing the cardiotoxicity of the cardiac muscle due several anti-cancer drugs***
  Experimentally *In-vitro* evaluation of the change in the active tension of the cardiac muscle of a rat as a result of a single dose of the anti-cancer drugs.
- ***Modeling of Electromechanical Disorders and CRT Therapy on Simulia's Living Heart Model (LHM)***
  As part of the Living heart project consortium with Dassault Systems our AUC group in coordination with Magdi Yacoub heart foundation is aiming to better calibrate the electromechanical model in the LHM.

Ph.D. Candidate, University of Guelph Sep. 03 – May. 10

A Closed Loop System for Partial Restoration of Spinal Cord Reflex Function
This research explores on how to replace damaged nerves in the central nervous system with artificial "nerves" that mimic the information processing of biological nerves and not just its functional role. A proof of concept system was developed to mimic the information processing of dorsal roots to regain spinal reflexes after spinal cord injuries. The designed system includes neural electrodes, signal conditioning and control circuitry. Functional testing of the system was performed both *in vitro* in saline solution and *in vivo* on a dog.

M.Sc. Student, The American University in Cairo Jan. 01 – Jul. 03

Optimization of solid waste management systems using operational research methodologies was applied to Port Said, Egypt

In this research, a proposed model for a municipal solid waste management system in Port Said, Egypt is presented. It includes the use of the concept of collection stations, which have not yet been used in Egypt. Mixed integer programming is used to model the proposed system and its solution is performed using MPL software V4.2.

B.Sc. Student, The American University in Cairo Jan.00 – Dec. 00

Design and fabricate a lab Automated Guided Vehicle (AGV)

This vehicle was capable of following a pre-drawn tape route. The AGV motion was controlled using a Programmable Logic Control (PLC), which receives input signals from the guidance and proximity sensors and sends output signals to the driving and steering motors. The AGV payload was 20 kg.

Publications:

Journal Publications

- A. Heidari, K.I. Elkhodary, C. Pop, **M. Badran**, H. Vali, Y. Abdel-Raouf,, ... & H.A. Tafti. "Patient-specific finite element analysis of heart failure and the impact of surgical intervention in pulmonary hypertension secondary to mitral valve disease". Medical & Biological Engineering & Computing. Vol. 60, pp 1723-1744, **2022**. https://doi.org/10.1007/s11517-022-02556-6
- M. Arshad, A. Hussain, A. Hassan, I. Khan, **M. Badran**, S. Mehrez, A. Elfasakhany, T. Abdeljawad, & Galal, A. M. . "Heat Transfer Analysis of Nanostructured Material Flow over an Exponentially Stretching Surface: A Comparative Study. Nanomaterials. Vol. 12, No. 7, pp. 1204. **2022** https://doi.org/10.3390/nano12071204
- N.Y. Sattar, Z. Kausar, S.A, Usama, U. Farooq, M.F. Shah, S. Muhammad, R. Khan, & **Badran, M.** "fNIRS-Based Upper Limb Motion Intention Recognition Using an Artificial Neural Network for Transhumeral Amputees". Sensors. Vol. 22, No. 3, pp.726, **2022**. https://doi.org/10.3390/s22030726
- **M. Badran**, A. Mansour "Evaluating Performance Indices of Electrostatic Precipitators: A Review" Energies, Submitted May **2022**.
- A. Khaled, D. Waheed, S. Hany, C. Morkos, M. Sabri, and **M. Badran** "Design and Testing of A ROS Operated Smart Obstacle avoidance wheelchair," International Journal of Mechanical Engineering and Robotics Research. Vol. 9, No. 7, pp 931-936, **2020**. https://doi.org/10.18178/ijmerr.9.7.931-936
- **M. Badran** and S. M. El-Haggar, "Optimization of municipal solid waste management in Port Said – Egypt," Waste Management., Vol. 26, pp. 534-545, **2006**. https://doi.org/10.1016/j.wasman.2005.05.005

Conference Publications

- **M. Badran**, "Modeling and Simulation of a Low Voltage Electroosmotic Micropump for Non-Newtonian Fluids" in *EuroSimE, 19-22 Apr. 2021. Proceedings : EurosimE Virtual Event* ***2021.*** *https://doi.org/*10.1109/EuroSimE52062.2021.9410857
- A. Mansour, **M. Badran** *"Modelling and Simulating the Effect of the Different Geometric Parameters on Voltage-Current Characteristics for Wire-Plate Electrostatic Precipitator with Different Collector Configurations"* in *EuroSimE, 6-8 Jul. 2020. Proceedings. Krakow: EurosimE Virtual Event* ***2020.*** https://doi.org/10.1109/EuroSimE48426.2020.9152744
- **M.Badran**, "On the Modeling and Simulation of Electroosmotic Micropump for Biomedical Applications," *in COMSOL Multiphysics Conference, 18-20 Oct. 2017. Proceedings. Rotterdam: COMSOL, 19 Oct.* ***2017****, online.*
- **M.Badran,** "Simulation of the Geometric Design Parameters' Impact on the Performance of EHD Ion-Drag Micropump," *in COMSOL Multiphysics Conference, 7-9 Oct. 2015. Proceedings. Boston: COMSOL, 9 Oct.* ***2015****, online.*
- **M. Badran** and M. Moussa, "BioMEMS implants for neural regeneration after a spinal cord injury," in *MEMS, NANO and Smart Systems, 2005. Proceedings. 2005 International Conference on,* **2005**, pp. 89-90. https://doi.org/10.1109/ICMENS.2005.31
- **M. Badran** and M. Moussa, "On the design of an electrohydrodynamic ion-drag micropump," in *MEMS, NANO and Smart Systems, 2004. Proceedings. 2004 International Conference on,* **2004**, pp. 137-140. https://doi.org 10.1109/ICMENS.2004.1508934

Paper Presentation

- A. Khaled, D. Waheed, S. Hany, C. Morkos, M. Sabri, and **M. Badran** "Design and Testing of A ROS Operated Smart Obstacle avoidance wheelchair," in ECMMM, 15-17 Feb. 2020. Athens: ECMMM, 16 Feb. **2020**

Thesis

- **M. Badran**, "A closed loop system for partial restoration of spinal cord reflex," *Ph.D. Thesis,* **2010**.
- **M. Badran**, "Optimization of Municipal Solid Waste Management in Port Said," *Master's Thesis,* **2003**.

Research Grants:

External Grants:

STDF: Call 9/ Technology Development Grant (PI)

"Light Weight Lower Limb Exoskeleton Prototype for Paraplegic Patients"

EGP 198,000 (~US $12,260) (Rejected) – Submitted Dec. 2019

UC Strategic Partner Visiting Scholar **Aug. – Sept. 2020**

Short Visit to Prof. Ahn (Microsystems and BioMEMS Laboratory)

Research Collaboration with Prof. Ahn on BioMEMS Devices

Accommodation and Air Travel expenses (Granted) Postponed due to COVID

Internal Grants:

The American University in Cairo

- **Bartlett Fund for Critical Challenges (Co-PI)** ***Mar. 20-May 23.***

"Surviving Cancer to Die of Heart Disease? Predicating when Stopping this Killer

Disease Will Stop Hearts"
US $ 83,240 (Granted)

Future University in Egypt

- **Strategic Research (PI)** **Sep. 17-Aug. 22**
  "Modeling and Optimizing Micropumps for biomedical applications"
  EGP. 3,000,000 (~US $ 167,000) (Granted)
- **Graduation Project Fund (PI)** **Sept. 20- Jul. 21**
  "Remotely Operated Underwater vehicle for Fish Farm"
  EGP. 20,000 (~US $1,300) (Granted)
- **Graduation Project Fund (PI)** **Sept. 19- Jun. 20**
  "A lightweight lower limb Exoskeleton Prototype"
  EGP. 12,000 (~US $ 750) (Granted)
  "Smart Navigation Wheel chair with an assistive robot arm"
  EGP. 14,000 (~ US $ 900) (Granted)
- **Graduation Project Fund (PI)** **Sep. 17- Jun. 18**
  "Smart Obstacle Avoidance Wheelchair"
  EGP. 27,000 (~US $ 1,500) (Granted)
- **Graduation Project Fund (PI)** **Sep. 16- Jun. 17**
  "Automated Storage and Retrieval system prototype for small products"
  EGP. 30,000(~US $ 1,700) (Granted)
- **Graduation Project Fund (PI)** **Sep. 15- Jun. 16**
  "Industrial Automated Guided Vehicle for LEONI Manufacturing Facility"
  EGP. 30,000 (~US $ 1,700) (Granted)
- **Graduation Project Fund (PI)** **Sep. 13- Jun. 14**
  "Automated Guided Vehicle for material Testing Lab"
  EGP. 21,000(~US $ 1,200) (Granted)

Travel Grants (International Conferences):

Future University in Egypt, ***(US $ 300) Online Registration***	Apr. 21
Future University in Egypt, ***(US $200) Online Registration***	Jul. 20
Future University in Egypt, ***(US $ 2,000)***	Jan. 20
Future University in Egypt, ***(US $ 2,000)***	Oct. 17
Future University in Egypt, ***(US $ 2,000)***	Oct. 15

Graduate Supervision:

The American University in Cairo

- Mr. Yousof Abdel-Raouf, M.Sc., "A Patient Specific Adaptation of the Living Human Heart Model in Application to Pulmonary Hypertension", Jun. **2020**
- Mr. Andrew Athanasios, M.Sc., "A Computational Model for Dilated Cardiomyopathy: Morphology and Electromechanics" Dec. **2018**

Undergraduate Graduation Project Supervision:

Future University in Egypt

"Remotely Operated Underwater vehicle for Fish Farm"	**Sept. 20- Jul. 21**
"A lightweight lower limb Exoskeleton Prototype"	**Sept. 19- Jun. 20**
"Smart Navigation Wheel chair with an assistive robot arm"	

"*Smart Obstacle Avoidance Wheelchair*", **Sept.17-Jun 18**
"*Automated Storage and Retrieval system prototype for small products*" **Sep.16-Jun 17**
"*Industrial Automated Guided Vehicle for LEONI Manufacturing Facility*" **Sep. 15-Jun.16**
"*Automated Guided Vehicle for material Testing Lab*" **Sep. 13-Jun.14.**

- **Industrial Experience**

Movenpick Heliopolis Hotel & Casino, Cairo, Egypt Apr. 01 – Aug. 03

Project Coordinator

- Developed the schedule for different renovation projects.
- Monitored the progress of the different project phases in relation to the project schedule.
- Negotiated with suppliers and contractors their execution plan of the renovation projects to adhere to the schedule.
- Supervised the execution of the project works and the interaction between the different contractors.
- Held Project meetings for the renovation projects.

Unilever, Cairo, Egypt Jul.– Aug. 00

Industrial Trainee

- Analyzed the different possibilities for the Upgrading of Unilevers' Pilot plant.
- Took the required actions for upgrading and assessed different offers for Unilevers' pilot plant.

- **Academic Service to the community**

Future University in Egypt

- Supervised the FUE student team competing at the First National Contest for Industrial Robotic Applications
- Contact person of ME / FUE with ME/University of Cincinnati (UC) where there is FUE/UC cooperation protocol.
- Academic advising of Mechanical Engineering Students
- Member of several committees for quality assurance activities such as Ethics of scientific research, Cultural Relations and Scientific research.
- Member of mechanical engineering curriculum reform committee.
- Internal Quality Assurance Auditor, Mechanical Engineering Dept.
- Head, Technical Committee for receiving the material testing lab equipment
- Member, Technical Committee for equipment purchasing for PLC and data acquisition lab.
- Examiner, Undergraduate Graduation Project.

The German University in Cairo

- External Examiner, Undergraduate Graduation Projects, 2021

The American University in Cairo

- External Examiner, Undergraduate Graduation Project, 2012.
- Member, End of year evaluation and strategic planning retreat for the school of Engineering, 2011, 2012, & 2022.

University of Guelph

- Member, Academic-End of year Department meeting to evaluate Phys1070-1080-1130, 2009.

External

- Member, Evaluation meeting for the Canadian microelectronic cooperation, 2009.
- Reviewer, Journal of Environmental Management
- Technical Committee Member, 10th International Conference on Control, Mechatronics and Automation, 2022
- Technical Committee Member, 9th International Conference on Control, Mechatronics and Automation, 2021.
- Technical Committee Member, 8th International Conference on Control, Mechatronics and Automation, 2020.
- Technical Committee Member, 7th International Conference on Control, Mechatronics and Automation, 2019.

Scholarships and Awards:

Mar.17	Faculty of Engineering Nominee for Future University in Egypt outstanding teaching award
Sep. 03- Jan. 06	University of Guelph Graduate Scholarship (4 times).
Feb. 98-Feb 00	Academic Honors for Outstanding Achievement in Mechanical Engineering, The American University in Cairo (3 times).

Professional Affiliations:

- Member, American Society of Mechanical Engineers, ASME, since 2000.
- Member, Institute of Electrical and Electronic Engineers, IEEE, since 2004.
- Member, Canadian Micro-Electronic Corporation, CMC, since 2004.
- Member, Egyptian Engineering Syndicate, since 2001.

Personal information:

- Born on the 11th of November 1977 in Cairo, Egypt.
- Dual Citizenship Canadian and Egyptian.