Khalil Al Handawi

🏠 Montréal Québec, Canada
📞 (514) 572-7367
✉ khalil.alhandawi@mail.mcgill.ca
🌐 khbalhandawi.github.io
⌂ github.com/khbalhandawi
in linkedin.com/in/khbalhandawi

Profile

Research	Design for changing requirements. Multidisciplinary design optimization. Instrumentation and state estimation.

Technical

ENGINEERING SYSTEMS	- Design for flexibility and robustness - Reliability and uncertainty quantification (Monte-Carlo with importance sampling)
MODELING AND SIMULATION:	- Finite element methods (thermomechanical, structural, electromagnetic) - Agent-based methods - System dynamics models
OPTIMIZATION:	- Blackbox and derivative-free optimization (Mesh-adaptive direct search) - Stochastic optimization
MACHINE LEARNING:	- Deep learning (Recurrent neural networks) - Reinforcement learning (Q-learning) - Hyperparameter optimization
Software	MATLAB and Simulink, Python (PyTorch, matplotlib), C++ (CUDA, OpenMP, Qt) FEA (Abaqus, ANSYS), CAD (SOLIDWORKS, NX Siemens), DAQ (NI LabVIEW)

Education

JAN 2017 – DEC 2020	**Doctor of Philosophy**	*McGill University*
	Mechanical Engineering , CGPA: 4.00	
CONCENTRAION	Engineering design and optimization	
DISSERTATION	*Optimization driven set-based design under uncertain requirements*	
AUG 2013 – DEC 2015	**Master of Science**	*Khalifa University*
	Mechanical Engineering , CGPA: 4.00	
CONCENTRAION	Instrumentation and photonics	
DISSERTATION	*Internal corrosion detection of oil and gas pipelines using fiber optics*	
AUG 2009 – JUNE 2013	**Bachelor of Science**	*Khalifa University*
	Mechanical Engineering , FIRST CLASS HONOURS, CGPA: 3.97	
CAPSTONE PROJECT	*Development of a human operated mobile hexapod platform*	

Experience

JAN 2021 – PRESENT	**Systems Optimization Lab, McGill University**	MONTRÉAL, CANADA
	Postdoctoral Researcher	

- Built a stochastic COVID model for predicting the spread of the disease in a population using agent-based approaches and used reinforcement learning algorithms to optimize public health policies.
- Applied stochastic optimization to hyperparameter optimization problems in machine learning.
- Lectured the engineering systems optimization class and developed MATLAB training modules and projects related to multidisciplinary optimization with applications to aircraft design.

JAN 2017 – JAN 2021	**McGill University**	MONTRÉAL, CANADA
	Research assistant	

- Won a Fonds de Recherche du Québec Nature et Technologie (FRQNT) grant (56,000 CAD).
- Developed mathematical frameworks for quantifying design flexiblity and robustness and managing uncertain requirements in aircraft system and subsystem design.

- Developed a thermomechanical simulation model for modeling additive manufacturing repair and life extension processes.
- Co-developed a novel lifecycle cost model based on system dynamics to model the effect of life extension on lifecycle costs.
- Used machine learning models to subsitute expensive thermomechanical simulations in design studies and developed a variant of kernel smoothing for estimating the sensitivity of design solutions to different requirements (Jacobian formulation).

June 2017 – Jan 2020   **GKN Aerospace Engine Systems**   Trolhättan, Sweden
Visiting researcher

- Participated in a technology transfer to translate my research on optimization into industrial practice by provided training modules and workshops to GKN engineers (MATLAB and Python).
- Surveyed GKN engineers about their experience designing areoengine components for engine system manufacturers to create a timeline of expected design updates and changes. This data formed the basis of a case study for my research on design for flexiblity and robustness.
- Set up advanced design automation and exploration tools to be used as part of GKN's workflow (engineering workbench) by integrated parameteric design software (NX Siemens) with simulation software (Abaqus and ANSYS) to evaluate hundreds of concepts for a turbine rear frame.

Jan 2019,2020   **Center for Autonomous Robotic Systems, Khalifa University**   Abu Dhabi, UAE
Visiting researcher

- Performed sensor fusion research with applications to unmanned aerial vehicle (UAV) control and manuevering.
- Fused UAV interial measurement unit (IMU) data with high latency positioning measurements from an Optitrack motion capture system to obtain smooth high frequency attitude estimates suitable for control applications.
- Used the principles of quaternion transformation to translate observed attitude in the IMU reference frame to an interial reference frame.
- Repurposed a DJI Wind 4 UAV for firefighting by redesigning the drone platform to carry an extinguishant payload.
- Co-authored a paper based on the repurposed UAV to be published in a special issue of the Journal of Field Robotics.

Aug 2013 – Dec 2016   **Asset Integrity Management Systems Lab, Khalifa University**   Abu Dhabi, UAE
Research Assistant

- Developed fiber optic sensors for monitoring mechanical and electrochemical phenomena such as strain, temperature, and corrosion.
- Used optical time-domain reflectometery for distributed fiber optic sensing of large structures such as oil pipelines.
- Worked with fiber Bragg grating sensors for localized measurements of strain and temperature and their subsequent translation into corrosion rate.
- Established a correlation between photoelastic properties of various waveguides (distrubuted and localized sensors) and the corrosion rate in oil and gas structures.
- Simulated photonic corrosion sensors in MATLAB and Abaqus for sensor design and calibration.
- Developed a novel accelerated corrosion testing setup based on electrochemical cells for validating and verifying the proposed corrosion sensors and establishing the calibration curve.

May 2014 – May 2015   **Khalifa University**   Abu Dhabi, UAE
Khalifa university Baja SAE team leader

- Lead the first UAE national team to compete in the Baja SAE competition (Maryland, 2015).
- Guided the assembly team on integrating vehicle subsystems (chassis, suspension, and power train).
- Performed structural optimization on vehicle chassis using MATLAB and ANSYS.

- Provided workshops on finite elemenet anaylsis and computer aided design to team members.
- Prepared assembly and part drawings for the manufacturing team.

Jan 2018 – Dec 2019 **McGill University** Montréal, Canada
Teaching assistant

- Mechanical lab course – Prepared lab manuals, conducted labs, graded student reports, and incorporated MATLAB programming exercises into the syllabus.
- Engineering Professional Practice course – Conducted town halls, hosted guest lecturers, provided feedback to students, and gave several talks about entrepreneurship.

Aug 2013 – Dec 2015 **Khalifa University** Abu Dhabi, UAE
Teaching Assistant

- System dynamics and controls course – Conducted lab sessions and held office hours.
- Computer aided design – Conducted computer lab sessions.
- Mentored undergraduate students participating in the Abu Dhabi Solar Challenge (building and designing a solar-powered vehicle).
- Co-mentored an undergraduate capstone project.

Aug 2012 – May 2012 **Yokogawa** Abu Dhabi, UAE
Engineering intern

- Wrote programs for industrial plant operation and control using distributed control systems.
- Visited the main headquarters in Japan to represent the Abu Dhabi National Oil Company.

Awards and recognition

May 2019 – Dec 2021	**Doctoral Research award (B2X)** *Fonds de Recherche du Québec - Nature et Technologies*	56,000 CAD
Jan 2017 – Dec 2019	**McGill Engineering Doctoral Award (MEDA)** *McGill University*	96,000 CAD
Aug 2013 – Dec 2015	**ADNOC Graduate fellowship** *Abu Dhabi National Oil Company*	90,000 USD

Team leader of the first team to successfully qualify and complete the Baja SAE competition	Khalifa University, Abu Dhabi, UAE
Awarded 2nd place in the Abu Dhabi Solar Challenge (10,000 AED)	Khalifa University, Abu Dhabi, UAE
Recognition for voluntary commitment to the Graduate School's and the Graduate Student Affair's events	Khalifa University, Abu Dhabi, UAE
Graduated Honors with distinction (2,000 AED)	Khalifa University, Abu Dhabi, UAE
Made it to the Provost's list 3 times	Khalifa University, Abu Dhabi, UAE

Publications

Submitted preprints

K. Al Handawi and M. Kokkolaras (2021). Optimization of infectious disease prevention and control policies using agent-based modeling. *IEEE Transactions on Emerging Topics in Computational Intelligence*, https://www.gerad.ca/en/papers/G-2021-07, (*Under Review*)
funded by an NSERC discovery grant

Refereed Journal Articles

K. Al Handawi, M. Panarotto, P. Andersson, O. Isaksson and M. Kokkolaras (2021). Optimization of design margins allocation when making use of additive remanufacturing. *Journal of Mechanical Design*, (*In Press*)
funded partially by NSERC, FRQNT, CARIC and EU Horizon 2020 research and innovation programme

M. Chehadeh, M. Wahbah, M. Awad, O. AbdulHay, **K. Al Handawi**, L. Seneviratne, I. Greatbatch and Y. Zweiri (2021). Novel aerial firefighting system for suppression of incipient cladding fires. *Journal of Field Robotics*, (*In Press*)
funded by Emaar Properties PJSC

K. Al Handawi, P. Andersson, M. Panarotto, O. Isaksson and M. Kokkolaras (2020). Scalable set-based design optimization and remanufacturing for meeting changing requirements. *Journal of Mechanical Design*, *143*(2): pp 021702. doi: 10.1115/1.4047908
funded partially by NSERC, FRQNT, CARIC and EU Horizon 2020 research and innovation programme

K. Al Handawi, N. Vahdati, O. Shiryayev and L. Lawand (2017). Analytical modeling tool for design of hydrocarbon sensitive optical fibers. *Sensors*, *17*(10): pp 2227. doi: 10.3390/s17102227
funded by Abu Dhabi National Oil Company

L. Lawand, O. Shiryayev, **K. Al Handawi**, N. Vahdati and P. Rostron (2017). Corrosivity sensor for exposed pipelines based on wireless energy transfer. *Sensors*, *17*(6): pp 1238. doi: 10.3390/s17061238
funded by Abu Dhabi National Oil Company

K. Al Handawi, N. Vahdati, P. Rostron, L. Lawand and O. Shiryayev (2016). Strain-based FBG sensor for real-time corrosion rate monitoring in pre-stressed structures. *Sensors and Actuators B: Chemical*, *236*: pp 276 – 285. doi: 10.1016/j.snb.2016.05.167
funded by Abu Dhabi National Oil Company

Conference Papers

K. Al Handawi, P. Andersson, M. Panarotto, O. Isaksson and M. Kokkolaras (2020). Scalable set-based design optimization and remanufacturing for meeting changing requirements. *in Proceedings of the International Design Engineering Technical Conferences & Computers and Information in Engineering Conference*, Virtual conference, IDETC2020.

L. Lawand, **K. Al Handawi**, M. Panarotto, P. Andersson, O. Isaksson and M. Kokkolaras (2019). A lifecycle cost-driven system dynamics approach for considering additive re-manufacturing or repair in aero-engine component design. *in Proceedings of the Design Society: International Conference on Engineering Design*, Delft, Netherlands, ICED19: pp 1343 – 1352. doi: 10.1017/dsi.2019.140

K. Al Handawi, N. Vahdati, O. Shiryayev, and L. Lawand (2016). Corrosion monitoring along infrastructures using distributed fiber optic sensing. *in Proceedings of SPIE Smart Structures/NDE, International Society for Optics and Photonics, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems*, Las Vegas, USA, SPIE2016. doi: 10.1117/12.2218820

L. Lawand, O. Shiryayev, **K. Al Handawi**, N. Vahdati and P. Rostron (2016). Corrosivity monitoring system using RFID-based sensors. *in Proceedings of SPIE Smart Structures/NDE, International Society for Optics and Photonics, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems*, Las Vegas, USA, SPIE2016. doi: 10.1117/12.2218813

COURSE WORK

- Advanced mechanics of materials
- Engineering systems optimization
- Continuum mechanics
- Applied numerical methods
- Applied finite element analysis
- Material engineering and corrosion
- Measurements and instrumentation
- Advanced vibrations
- Fracture mechanics
- Viscous and compressible fluid flows

PERSONAL INTERESTS

- Gymnastics and calisthenics training
- Powerlifting
- Competitive gaming
- 3d printing hobbyist
- Car modding (muscle cars) and drag racing
- Tinkering and taking apart any machine and putting it back together!