Khalil Al Handawi, PhD

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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*

WORK EXPERIENCE

Research

Transformation of Industry, Siemens Energy Canada MONTRÉAL, CANADA
AUG 2023 – PRESENT *R&D project manager*

- Design and propose future research projects with an impact on the energy industry.
- Manage and train university students working on various R&D projects.
- Disseminate research results at prominent turbomachinery and automation conferences.
- Ensure a smooth and continuous technology transfer for various R&D projects.

Department of Computer Science and Operations Research, Université de Montréal MONTRÉAL, CANADA
MAY 2022 – JULY 2023 *Postdoctoral Researcher*

- Developed a research plan and won a Natural Sciences and Engineering Research Council of Canada (NSERC) fellowship to pursue said research at Universite de Montréal.
- Work with the International Air Transport Association (IATA) to develop data analytics solutions for codesharing and flight scheduling in the civil aviation industry.
- Assess the effectiveness and impact of the IATA operation safety audit (IOSA) on air travel accessibility and cooperation between airlines.

Systems Optimization Lab (SOL), McGill University MONTRÉAL, CANADA
JAN 2021 – APR 2022 *Postdoctoral Researcher*

- Research simulation-based decision-making for public health policies during epidemics.
- Developed several machine learning COVID-19 forecasting models for inferring weekly pandemic trajectories.

- Applied state-of-the-art stochastic black-box optimization algorithms to tune machine learning hyperparameters and model selection.
- Develop GPU accelerated epidemic models for high simulation throughput to assist in policy-making during pandemics through the use of stochastic optimization.
- Invited to speak at the INFORMS Healthcare conference 2023 in Toronto.

JAN 2017 – JAN 2021 *Research assistant*

- Was part of a **Canadian/European industrial project** investigating additive repair technology for aeroengines. I focused on optimization of design for AM remanufacturing.
- Developed mathematical tools and software for design space exploration and optimization achieving a **90% reduction** in effort to explore a 4-dimensional design space relative to full factorial design.
- Developed a thermomechanical simulation model for modeling additive manufacturing repair and life extension processes using coupled thermal/mechanical FEA simulations.
- Used machine learning models trained from expensive manufacturing simulations and a variant of kernel smoothing for estimating the sensitivity of design and process parameters to different requirements.
- My doctoral research paper was selected as a **best paper** by the ASME Journal of Mechanical Design in 2021.
- Recived a Fonds de Recherche du Québec (FRQNT) doctoral award.
- Co-developed a novel lifecycle cost model based on system dynamics to model the effect of life extension on lifecycle costs.

Systems Engineering Design (SED) Lab, Chalmers University of Technology GÖTEBORG, SWEDEN

SEP 2021 – DEC 2021 *Postdoctoral Researcher*

- Integrate my doctoral research (design under uncertainty) into SED lab activities.
- Research change propagation and absorption in design (applied to aeroengine systems).
- Authored a Python library for margin analysis in engineering systems.
- Used said library in design space exploration to concurrently develop and analyze **6,552 conceptual designs** of an aeroengine component and visualize the results interactively.

Asset Integrity Management Systems (AIMS) Lab, Khalifa University ABU DHABI, UAE

AUG 2013 – JAN 2017 *Research Assistant*

- Developed fiber optic structural monitoring sensors to mitigate **$1M of corrosion costs**.
- Developed a fiber optic-based corrosion sensor with an accuracy of $\pm$**2mm/s**.
- Developed an accelerated corrosion test setup to simulate **2 years of corrosion in 2 hours**.

Industry

International Air Transport Association (IATA) MONTRÉAL, CANADA

MAY 2022 – PRESENT *Visiting researcher*

- Analyze IATA data involving **25M flight schedules** using graph representation learning.
- Develop community detection algorithms for heterogeneous graphs.
- Organize flight schedule data into a mySQL database for archival, and retrieval of data.

GKN Aerospace Engine Systems TROLHÄTTAN, SWEDEN

JUN 2017 – JAN 2020 *Visiting researcher*

- Participated in a technology transfer at GKN Aerospace to translate my doctoral research into industrial practice by provided training modules and workshops to GKN engineers on the software tools that I have developed.
- Surveyed GKN engineers about their design experience with areoengine components to understand the timeline for expected design updates and changes. This data formed the basis of a case study for my research on design for flexibility and robustness.
- Set up advanced design automation and exploration tools to be used as part of GKN's workflow (engineering workbench) by integrated parametric design software (NX Siemens) with simulation software (Abaqus and ANSYS) to evaluate hundreds of concepts for a turbine rear frame component.

Yokogawa ABU DHABI, UAE

AUG 2012 – MAY 2012 *Engineering intern*

- Write programs for industrial plant operation and control on Distributed Control Systems.
- Visited the main headquarters in Japan to represent the Abu Dhabi National Oil Company.

Management

Khalifa University ABU DHABI, UAE

JAN 2014 – AUG 2015 *Solar car project: Maintenance and procurement manager*

- Designed an engineering workshop for building and maintaining electric solar vehicles.

JUN 2011 – MAY 2013 *Baja SAE team leader*

- Was elected to lead the team during the Baja SAE 2013 and 2015 international competitions.
- Saw the project to completion and was recognized for leading the first UAE national team to participate in the Baja SAE competition.

TEACHING AND SUPERVISION

Teaching

McGill University MONTRÉAL, CANADA

SEP 2022 – DEC 2022 *Adjunct lecturer, MECH559: Engineering Systems Optimization*

- Developed Python notebooks as teaching aids to explain the implementation of common optimization algorithms and their application to engineering systems.
- Received participation rate of **69%** in course evaluations with an average score of **4.2/5.0**.
- Hosted **guest** lectures with industry professionals to demo optimization applications.

SEP 2018 – DEC 2019 *Teaching assistant, MECH362: Mechanical Lab*

- Was a teaching assistant for MECH362 for 3 semesters.
- Supervised lab sessions covering the following theoretical courses: MECH240 Thermodynamics, MECH315/419 Mechanics, MECH331 Fluid Mechanics, MECH346 Heat Transfer.
- Prepared lab manuals, conducted labs, graded student reports, and provided feedback.
- Report areas of the curriculum that students struggle with to the department.

JAN 2018 – MAY 2018 *Teaching assistant, FACC400: Engineering Professional Practice*

- Was a teaching assistant for FACC400 for 1 semester.
- Conducted town halls on relevant sociapolitical topics facing modern day engineers.
- Substituted lecturers, and provided feedback to students on the townhalls.

Khalifa University ABU DHABI, UAE

JAN 2014 – MAY 2014 *Teaching assistant, System Dynamics and Controls*

- Conducted lab sessions on transient systems and multiple degree of freedom systems.
- Prepared homework solutions and tutorials for the students on theoretical topics.
- Graded students' midterms examinations.

SEP 2013 – DEC 2013 *Teaching assistant, Computer Aided Design*

- Conduct computer lab sessions on modern CAD software (SolidWorks).

SEP 2012 – MAY 2013 *Grader, Physics II*

- Graded homework and exams for the undergraduate physics course.

Supervision

AUG 2023 – PRESENT **Digital multidisciplinary analysis and design optimization, Siemens Energy** MONTRÉAL, CANADA

- Student name: Abdessamad Idoumghar (Masters student)
  Affiliation: ETS
  Domain: Nonlinear programming, least squares
- Student name: Aravind Kumar Parthasarathy (Masters student)
  Affiliation: McGill University
  Domain: Solid mechanics, topology optimization
- Student name: Vraj Patel (Masters student)
  Affiliation: McGill University
  Domain: Combinotorial optimization, process engineering
- Student name: Anas Haitof (Masters student)
  Affiliation: ETS
  Domain: CFD, surge identification, and algorithm design
- Student name: Axel Koubemba (Masters student)
  Affiliation: ETS
  Domain: Multidisciplinary and Derivative-free optimization
- Student name: Mathieu Salz (Bachelors student)
  Affiliation: McGill University
  Domain: Physics informed neural networks, Aerodynamics
- Student name: Dan Mihail Bala (Bachelors student)
  Affiliation: ETS
  Domain: Derivative-free optimization

- Student name: Fozail Ahmad (PhD student)
  Affiliation: McGill University
  Domain: Cloud computing and software design

JAN 2016 – JAN 2017 **Asset Integrity Management Systems Lab (AIMS), Khalifa University** ABU DHABI, UAE

- Student name: Safieh Almahmoud (Masters student)
  Affiliation: Khalifa University
  Domain: Solid mechanics, instrumentation, and photonics
- Student name: Tasneem Osman (Masters student)
  Affiliation: Khalifa University
  Domain: Solid mechanics, instrumentation, and acoustics

JAN 2014 –- AUG 2015 **Capstone project, Khalifa University** ABU DHABI, UAE

- Student name: Yazan Hindawi (Bachelors student)
  Affiliation: Khalifa University
  Domain: Solid mechanics, instrumentation, and robotics
- Student name: Ali Shamlan (Masters student)
  Affiliation: Khalifa University
  Domain: Solid mechanics, instrumentation, and robotics

PUBLICATIONS

Refereed Journal Articles

K. Al Handawi, A. Brahma, D. Wynn, M. Kokkolaras and O. Isaksson (2023). Design space exploration and evaluation using margin-based trade-offs. *Journal of Mechanical Design*, *in press*, doi: 10.1115/1.4051607
funded partially by NSERC and Area of Advance of Chalmers University

K. Al Handawi, A. Brahma, D. Wynn, M. Kokkolaras and O. Isaksson (2023). Design space exploration and evaluation using margin-based trade-offs. *Journal of Mechanical Design*, *144*(1): pp 012001. doi: 10.1115/1.4051607
funded partially by NSERC, FRQNT, CARIC and EU Horizon 2020 research and innovation programme

A. Khalil, **K. Al Handawi**, Z. Mohsen, A. Abdel Nour, R. Feghali, I. Chamseddine and M. Kokkolaras (2022). Weekly nowcasting of new COVID-19 cases using past viral load measurements. *Viruses*, *14*(7): pp 1414. doi: 10.3390/V14071414

K. Al Handawi and M. Kokkolaras (2021). Optimization of infectious disease prevention and control policies using artificial life. *IEEE Transactions on Emerging Topics in Computational Intelligence*, doi: 10.1109/TETCI.2021.3107496
funded by an NSERC discovery grant

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*, *144*(1): pp 012001. doi: 10.1115/1.4051607
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*, *1*: pp 203 – 230. https://doi.org/10.55417/fr.2021008
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

Submitted conference papers

M. Sage, **K. Al Handawi**, Y. F. Zhao (2024). Economic Dispatch of Hybrid Renewable Energy Systems with Battery Energy Storage and Gas Turbines using Deep Reinforcement Learning *IISE Annual Conference and Expo*

Can Unlusoy, M. Salz, B. Maier, **K. Al Handawi**, M. V. Tittu, R. Srinivasan, M. Kokkolaras (2024). Advancing Airfoil Design: A Generative AI and PINNs Approach *ASME 2024 Turbomachinery Technical Conference & Exposition*

Refereed Conference Papers

L. Lawand, T. Hajali, **K. Al Handawi** and A. Brahma (2023). Industrialisation of additive manufacturing: Assessing the impact of excess margins on manufacturing costs. *in Proceedings of the 9th International Conference on Research Into Design*, Bengaluru, India, ICoRD'23.

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, L. Lawand , P. Andersson, R. Brommesson, O. Isaksson and M. Kokkolaras (2018). Integrating additive manufacturing and repair strategies of aeroengine components in the computational multi-disciplinary engineering design process. *in Proceedings of NordDesign*, Linköping, Sweden, NordDesign 2018.

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

Poster presentations

K. Al Handawi, P. Andersson, O. Isaksson and M. Kokkolaras (2019). Scalable set-based design solutions for product remanufacturing. *International Conference on Engineering Design*, Delft, Netherlands, ICED19.

K. Al Handawi, L. Lawand, T. Hitchcox, Y. F. Zhao and M. Kokkolaras (2018). Additive manufacturing optimization and simulation platform for repairing and remanufacturing of aerospace components. *CRIAQ RDV Forum*, Montréal, Canada.

AWARDS AND RECOGNITION

MAY 2022 – APR 2024	**Postdoctoral fellowship (PDF)** *National Sciences and Engineering Research council Canada*	90,000 CAD
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

Our paper on scalable designs was selected for the **2021 ASME Journal of Mechanical Design Editor's Choice award**	ASME IDETC 2022, ST. LOUIS, USA
Awarded **2nd place** for final problem presentation and winner of best data visualization in the 11th Montreal Industreal Problem Solving Workshop	IVADO, UNIVERSITÉ DE MONTRÉAL, CANADA
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

RESEARCH INTERESTS

- Artificial intelligence in engineering design
- Design for changing requirements
- Robust design
- Reliability
- Numerical simulation
- Systems optimization
- Surrogate modelling
- Stochastic programming
- Derivative-free optimization
- Computer aided design
- Computer aided engineering
- Manufacturing

REVIEW SERVICE

Served as a reviewer on the following journals:

Journal	Number of papers
Designs	1
Scientific Reports	2
Sensors and Actuators A	2
IEEE Access	6
Journal of Global Optimization	1
Engineering Optimization	1
Artificial Intelligence for Engineering Design, Analysis and Manufacturing	2
AIAA Journal	2
IEEE Transactions on Industrial Informatics	1
Journal of Mechanical Design	1
The Aeronautical Journal	3