

Khalil Al Handawi, PhD

Curriculum Vitae



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ABOUT ME

I believe that physics and artificial intelligence should be two sides of the same coin. One cannot exist without the other. How? By cross-validation. In this way, the toughest physics and mathematics problems can be solved! This philosophy is what drives my research.

RESEARCH

“Optimization-driven set-based design for dynamic design requirements”

How do you design a component when the design requirements can change at any moment and without advance notice? That is the question my dissertations tries to answer. To do so, I came up with design metrics for qualitative descriptions such as flexibility and robustness. I used optimization, automation and machine learning to obtain thousands of possible designs. This is a **1000 fold** increase in the number of alternatives that are presented during client meetings. By exploring all these alternatives potential cost savings in the order of **millions** of dollars can be made over a period of decades. My research culminated in a technology transfer at GKN aerospace so that engineers can go to work, incorporating these algorithms in their workflows and give GKN a **competitive edge**.

python C++ MATLAB R Online open-source code Online news article

“Optimization of infectious disease prevention policies using agent-based modeling”

How can we apply the principles of design and decision making to help bring the pandemic under control? To answer this question, I modeled how an infectious disease spreads in a small population. Diseases such as COVID-19 spread through social interaction. I programmed intelligent agents to model a complex social system. Optimization can be used to determine the critical amount of intervention necessary to keep the disease in check. I used these algorithms to reduce the number of hospitalizations beneath the healthcare capacity while reducing the socio-economic cost of interventions by up to **5 times** compared to a complete lock-down.

C++ CUDA python Qt Online open-source code

EDUCATION

JAN 2017 – DEC 2020	Doctor of Philosophy Mechanical Engineering , CGPA: 4.00	McGill University
AUG 2013 – DEC 2015	Master of Science Mechanical Engineering , CGPA: 4.00	Khalifa University
AUG 2009 – JUNE 2013	Bachelor of Science Mechanical Engineering , FIRST CLASS HONOURS, CGPA: 3.97	Khalifa University

ACADEMIC EXPERIENCE

JAN 2021 – PRESENT	Systems Optimization Lab, McGill University Postdoctoral Researcher <ul style="list-style-type: none">Built and implemented COVID-19 predictive model in a time of uncertainty.Came up with a project that lets students explore multidisciplinary optimization for designing an aircraft.	MONTRÉAL, CANADA
JAN 2017 – JAN 2021	McGill University Research and teaching assistant <ul style="list-style-type: none">Came up with new ways to teach programming skills to engineering students.Advanced the field of design optimization to generate thousands of design alternatives and potential cost savings spanning decades of operating costs.	MONTRÉAL, CANADA

JAN 2016 – JAN 2017	Asset Integrity Management Systems Lab, Khalifa University <i>Research Assistant</i> <ul style="list-style-type: none"> • Came up with corrosion monitoring devices and software that saved the industry \$1,000,000 worth of maintenance costs. • Developed a wide range of fiber optic sensors that cost a fraction of their electrical counterparts. 	ABU DHABI, UAE
AUG 2013 – DEC 2015	Khalifa University <i>Graduate Research Assistant</i> <ul style="list-style-type: none"> • Lead the 1st national team to ever compete in the international SAE competition. • Built, designed and competed in the first Abu Dhabi Solar Challenge. 	ABU DHABI, UAE

MANAGEMENT EXPERIENCE

JAN 2021 – PRESENT	BPGIC holdings Limited <i>Non-executive independent member of board of directors</i> <ul style="list-style-type: none"> • Make decisions on the BPGIC holdings Limited board of directors to further the company's objective of expanding its operations in the energy sector. • Attend quarterly board of directors meetings and provide expert opinion and advice. 	DUBAI, UAE
JAN 2017 – PRESENT	Systems Optimization Lab, McGill University <i>Website manager</i> <ul style="list-style-type: none"> • Update the lab's website and disseminate new research to the public. • https://www.sol.research.mcgill.ca. 	MONTRÉAL, CANADA
JAN 2017 – PRESENT	Solar car project, Khalifa University <i>Maintenance and procurement manager</i> <ul style="list-style-type: none"> • Designed a cutting edge engineering workshop for building and maintaining electric solar vehicles. 	ABU DHABI, UAE
JAN 2017 – PRESENT	Baja SAE team, Khalifa University <i>Project team manager</i> <ul style="list-style-type: none"> • 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. 	ABU DHABI, UAE

WORK EXPERIENCE

JAN 2017 – JAN 2020	GKN Aerospace Engine Systems <i>Visiting researcher</i> <ul style="list-style-type: none"> • Transfer academic research to the industry by providing training and workshops. • Collect information about industrial workflows to guide academic research. 	TROLHÄTTAN, SWEDEN
AUG 2012 – MAY 2012	Yokogawa <i>Engineering intern</i> <ul style="list-style-type: none"> • Created software and 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. 	ABU DHABI, UAE

STUDENT SUPERVISION EXPERIENCE

JAN 2017 – JAN 2020	<i>Asset Integrity Management Systems Lab, Khalifa University</i> <ul style="list-style-type: none"> • Student name: Safieh Almahmoud (Masters student) Affiliation: Khalifa University Domain: Solid mechanics, instrumentation, and photonics 	ABU DHABI, UAE
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- Student name: Tasneem Osman (Masters student)
Affiliation: Khalifa University
Domain: Solid mechanics, instrumentation, and acoustics

JAN 2014 -- AUG 2015 **Senior graduation 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

TEACHING EXPERIENCE

SEP 2018 – DEC 2019	Teaching assistant for the mechanical lab (MECH 362) course for 3 semesters – prepared lab manuals, conducted labs, graded student reports, and provided feedback.	MCGILL UNIVERSITY, MONTRÉAL, CANADA
JAN 2018 – MAY 2018	Teaching assistant for the Engineering Professional Practice (FACC 400) course for 1 semester – Conducted town halls, substituted lecturers, and provided feedback to students.	MCGILL UNIVERSITY, MONTRÉAL, CANADA
JAN 2014 – MAY 2014	Teaching assistant for the System dynamics and controls course (including preparing lab sessions, office hours for students and grading midterm examinations). The TA duties also included conducting lab sessions (Transient systems and multiple degree of freedom systems).	KHALIFA UNIVERSITY, ABU DHABI, UAE
SEP 2013 – DEC 2013	Teaching assistant for the computer aided design course. Conducted computer lab sessions where students were taught CAD basics and guidelines for producing professional engineering drawings.	KHALIFA UNIVERSITY, ABU DHABI, UAE
SEP 2012 – MAY 2013	Grader for the Physics II undergraduate course. Graded student assignments, midterms and final examinations.	KHALIFA UNIVERSITY, ABU DHABI, UAE

RESEARCH INTERESTS

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

TEACHING INTERESTS

- Computer aided design
- Computer aided engineering
- Manufacturing
- Entrepreneurship
- Professional engineering ethics

RECOGNITION

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 the commitment of time, support and inspiration 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

AWARDS

MAY 2019 – DEC 2021	Doctoral Research award (B2X) <i>Fonds de Recherche du Québec - Nature et Technologies</i>	56,000 CAD
JAN 2017 – DEC 2019	McGill Engineering Doctoral Award (MEDA) <i>McGill University</i>	96,000 CAD
AUG 2013 – DEC 2015	ADNOC Graduate fellowship <i>Abu Dhabi National Oil Company</i>	90,000 USD

PUBLICATIONS

Refereed Journal Articles

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*, (Under Review)
funded by 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*, (Under Review)
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 re-manufacturing for meeting changing requirements. *Journal of Mechanical Design*, 143(2): pp 021702. doi: [10.1115/1.4047908](https://doi.org/10.1115/1.4047908)
funded partially by NSERC, FRQNT, CARIC and EU Horizon 2020 research and innovation programme

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

L. Lawand, O. Shirayev, **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](https://doi.org/10.3390/s17061238)
funded by Abu Dhabi National Oil Company

K. Al Handawi, N. Vahdati, P. Rostron, L. Lawand and O. Shirayev (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](https://doi.org/10.1016/j.snb.2016.05.167)
funded by Abu Dhabi National Oil Company

Refereed Conference Papers

K. Al Handawi, P. Andersson, M. Panarotto, O. Isaksson and M. Kokkolaras (2020). Scalable set-based design optimization and re-manufacturing 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](https://doi.org/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. Shirayev, 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](https://doi.org/10.1117/12.2218820)

L. Lawand, O. Shirayayev, **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](https://doi.org/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.

PREVIOUS RESEARCH

“Corrosion monitoring along infrastructures using distributed fiber optic sensing”

Oil pipelines are monitored for corrosion on regular intervals using conventional tools. A real-time monitoring solution was developed to avoid spontaneous failures that may occur between inspection intervals using distributed fiber optic sensors which are intrinsically safe. The sensor that we developed consisted of a silica core and a polymer cladding coated with a metal layer from the pipeline's construction which upon corrosion exposes it to hydrocarbons altering its refractive index. Intensity of a travelling pulse drops and is captured by reflectometry techniques. The system was simulated, and a laboratory scale setup was developed to validate the model and test the solution. Our setup featured advanced fiber optic sensors (fiber Bragg grating (FBG)), interrogators (optical time domain reflectometer (OTDR)), and spectral analyzers controlled and operated by LabVIEW data acquisition software. We also relied heavily on MATLAB simulations to construct and verify the setup.

● fiber Bragg grating (FBG) ● optical time domain reflectometry (OTDR) ● LabVIEW ● MATLAB

“Development of a human operated mobile hexapod platform”

I designed and developed of a six-legged hexapod platform that employed a hydraulic system to actuate each of the six robotic manipulators used for locomotion. The control and distribution of the hydraulic power was controlled through state-of-the art technology employing hydraulic servo-valves. As of today, the design stands at a total weight of 3 tons and occupies a space of 5m x 2m x 3m high. The robotic manipulator which constitutes a leg of the hexapod was reverse engineered and repurposed for walking from a used JCB hydraulic excavator. I made a faithful reproduction of the 3D CAD model in Solidworks by taking measurements from the physical excavator so that the necessary modifications can be designed and manufactured. Most modifications were manufactured manually using a milling machine, lathe, and MIG/TIG welding. More complex parts where tolerances were critical were machined via a CNC milling machine. Once the mechanical setup was built, I used kinematics, and rotation matrices to compute the necessary actuation for tracking a given trajectory. I used and configured a microcontroller (Arduino) to provide the actuation signal to the servo-valves that distribute hydraulic power throughout the hexapod and achieved smooth tracking of the trajectory.

● Solidworks ● manufacturing ● CNC machining ● kinematics ● rotation matrices ● Arduino

EXTRACURRICULAR PROJECTS

“Khalifa university Solar Car Project”

I was part of the Khalifa University Solar Car Team which successfully developed and commissioned the **first** solar vehicle in The United Arab Emirates. The vehicle was of outstanding performance and competed in The Abu Dhabi Solar Challenge (January 15th – 19th 2015) earning **second place** in the race with 2 minutes behind the leading team (University of Michigan, Ann Arbor). My responsibilities in the team included aerodynamic design of the body and driver canopy using ANSYS Fluent. Furthermore, after the design stage my main responsibilities were to oversee the manufacturing of the various components needed to operate the vehicle as well as procure the equipment needed to build and maintain the vehicle. In order to fabricate the monocoque carbon fiber chassis of the vehicle, I collaborated with a team of solar car designers at **Tokai University, Japan**. The project provided a lot of hands-on inter-disciplinary experience in instrumentation, mechanical, and electrical design.

● aerodynamic design ● ANSYS Fluent ● carbon fiber ● [Online news article](#)

“Khalifa university Baja SAE Project”

I led and supervised a team of engineering students to design and produce a vehicle to compete in the SAE Baja Event during the summer of 2015. This project provides extensive hands-on experience on fabrication of various automotive parts using CNC technology, welding and conventional machining. Furthermore, I acquired a lot of experience throughout the design process on CAD modeling (Solidworks, Autodesk AutoCAD) and simulation (FEA Analysis of the Chassis using ANSYS mechanical APDL). The built design qualified for the Baja SAE 2015 annual competition in Maryland, United States, which was the university's first undertaking in competing overseas. Being the team's first encounter with overseas competitions, the vehicle passed rigorous technical inspection requirements and successfully completed all the events and the endurance race arriving at a rank of **58 out of a total of 100** competing international university teams.

● Solidworks, Autodesk AutoCAD ● manufacturing ● CNC machining ● ANSYS mechanical APDL

SPECIAL ELECTIVE COURSES

Advanced mechanics of materials (PhD)	MCGILL UNIVERSITY, MONTRÉAL, CANADA
Engineering systems optimization (PhD)	MCGILL UNIVERSITY, MONTRÉAL, CANADA
Continuum mechanics (MSc)	KHALIFA UNIVERSITY, ABU DHABI, UAE
Applied numerical methods (MSc)	KHALIFA UNIVERSITY, ABU DHABI, UAE
Applied finite element analysis (MSc)	KHALIFA UNIVERSITY, ABU DHABI, UAE
Material engineering and corrosion (MSc)	KHALIFA UNIVERSITY, ABU DHABI, UAE
Advanced dynamics (MSc)	KHALIFA UNIVERSITY, ABU DHABI, UAE
Measurements and instrumentation (MSc)	KHALIFA UNIVERSITY, ABU DHABI, UAE
Fracture mechanics (BSc)	KHALIFA UNIVERSITY, ABU DHABI, UAE
Viscous and compressible fluid flows (BSc)	KHALIFA UNIVERSITY, ABU DHABI, UAE

SERVICE TO ACADEMIA

Served as a reviewer on the following journals:

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

COMPUTER SKILLS

PROGRAMMING	Python ○○○○○○○○○○ C++ ○○○○○○○○○○ VB ○○○○○○○○○○ R ○○○○○○○○○○ Matlab ○○○○○○○○○○ HTML, CSS ○○○○○○○○○○ Javascript ○○○○○○○○○○
OPERATING SYSTEMS	Microsoft Windows(cmd and powershell), Linux - Debian (bash), MacOS (Zsh, bash)
LIBRARIES/Frameworks	Qt, PyTorch, TensorFlow, CUDA, Intel MPI, OpenCL
SOURCE CONTROL	Git, Perforce
IDES	VSCode, Xcode, Visual Studio
TYPESETTING	L ^A T _E X(and beamer), Microsoft Office
FEM SOFTWARE	Ansys-APDL (structural and LS-DYNA), Abaqus, COMSOL, NASTRAN
APIS	Abaqus python API and Fortran subroutines, NX siemens python and visual basic API
CFD SOFTWARE	Ansys (CFX, Fluent, Workbench)
CAD AND GRAPHICS	Autodesk Inventor (3D), Autodesk autocad (2D), Solid works (3D), SE-Fit, Geomagic, Catia, NX siemens, Keyshot, Meshlab, FreeCAD

SKILLS

Goal Oriented

I believe in action over long-winded discussions. I listen to everyone's viewpoints and use my judgement to immediately act based on consensus to achieve goals quickly and efficiently.

Passionate

I have been interested computers and video games as long as I can remember. I dedicated my career to understanding the mathematics that drives these fascinating machines. I love using my knowledge of physics and engineering to bridge the gap between the real and virtual computer worlds.

Communication

- Excellent communication and presentation skills, written and verbal
- Comfortable with working in a target-driven and fast paced environment
- Data analysis, proposal writing and questionnaire design
- Attention to detail and ability to identify underlying trends and patterns

Physical Dexterity

I specialize in gymnastics and calisthenics training for sound body and mind necessary to maintain focus needed for innovative problem-solving.

PERSONAL INTERESTS

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

SPOKEN LANGUAGES

ENGLISH	Spoken	⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿
	Written	⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿
ARABIC	Spoken	⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿
	Written	⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿
FRENCH	Spoken	⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿
	Written	⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿
SWEDISH	Spoken	⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿⦿
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REFERENCES

Prof. Michael Kokkolaras		Prof. Nader Vahdati	
POSITION	Associate Professor	POSITION	Associate Professor
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EMAIL	michael.kokkolaras@mcgill.ca	EMAIL	nader.vahdati@ku.ac.ae
Prof. Oleg Shiryayev		Prof. Peter Rodgers	
POSITION	Assistant Professor	POSITION	Professor and Associate VP Research Engagement
EMPLOYER	Department of Mechanical Engineering <i>University of Alaska Fairbanks</i>	EMPLOYER	The Petroleum Institute Research Center <i>Khalifa Univeristy</i>
EMAIL	oshiryayev@alaska.edu	EMAIL	peter.rodgers@ku.ac.ae