

# Abdullah A. Alhadlaq

RESEARCH SPECIALIST

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## Education

### Columbia University

New York, NY, USA

M.S. IN ELECTRICAL ENGINEERING

Sep. 2021 - present

- Current CGPA of 4.12/4
- Enrolled in the MS EE Honors program awarded to the top 10% of students
- Course Assistant in the Convex Optimization for Electrical Engineering Course (EEOR 4650) Fall 2022

### Dalhousie University

Halifax, NS, Canada

B.S. IN ELECTRICAL ENGINEERING WITH COMPUTER OPTION

Sep. 2013 - May 2018

- Graduated with a CGPA of 4.17/4.3
- Maintained a position on the Dean's List in all academic semesters
- Designated the title "Sexton Scholar" for excellent academic performance
- Completed the senior year project winning 2 university awards
- Was a member of the Engineering Peer Mentorship program, mentoring fresh undergraduate students

## Experience

### Center of Complex Systems (CCS) at KACST and MIT

Riyadh, Saudi Arabia & Boston, USA

RESEARCH SPECIALIST

Feb. 2019 - PRESENT

- Joined as a research specialist where I create optimization, statistical, and machine learning models to solve problems relating to the electric power system and its infrastructure
- Enhanced my ability to examine the literature in a given field, find the current gaps in the state of the art implementations, and develop testable hypotheses to contribute to the literature
- Studied the effect of renewable energy integration into the Saudi Arabian generation mix by designing and developing an optimization model able to measure the flexibility requirements of the power system, giving insightful output to decision makers
- Developed novel ensemble methodologies on top of time series forecasting models to predict the electricity demand of Saudi Arabia

### Dalhousie University

Halifax, NS, Canada

SYSTEM ANALYST

Jan. 2016 - April. 2016

- Discussed and documented the time management needs of the office of the associate dean of the engineering department, and developed a calendar system based on the requirements
- Developed an algorithm to predict the student growth rates in each course by understanding the flow of students between the different courses and calculating the flow rates based on historical data

### Alhadlaq Establishment (Family Owned Business)

Riyadh, Saudi Arabia

TECHNICAL MANAGER

Sep. 2009 - Aug. 2012

- Designed and installed a digital inventory system to manage and keep track of the contents of the different storage units
- Automated multiple managerial processes including payroll, vacation requests, and other administrative functions

## Research Projects

### Federated Learning

Columbia

PRINCIPLE INVESTIGATOR: PROF. JAMES ANDERSON - COLUMBIA

2021 - 2022

- Implemented a new algorithm developed by Prof. James' group (FedADMM) and ran multiple simulations with varying parameters
- Integrated multiple acceleration and adaptive learning techniques to the FedADMM algorithm and investigated its empirical effects on the run time of the simulations
- Implemented a version of the algorithm with data compression and error feedback, ran simulations to analyze its performance, and worked on deriving the convergence rate

## Energy Analytics

KACST - MIT

PRINCIPLE INVESTIGATOR: PROF. DEVAVRAT SHAH - MIT

2019 - 2021

- Developed a variety of time series models and designed a novel ensemble technique in order to provide accurate 3 day ahead predictions of the electricity power demand in Saudi Arabia
- Integrated new time series prediction features that are fit to the Saudi context, such as prayer times and special events into the developed forecasting models
- Executed live tests on the developed models using real-time demand from the Saudi electricity Company (SEC), and the models outperformed global well-established forecasting tools. It has then been commercialized by a third party entity to SEC under the name E-Cast
- Developed a power system simulation sandbox following the OpenAI reinforcement learning environment standard that allows the user to define different types of generating units with their characteristics

## Power System Modeling and Optimization

KACST - MIT

PRINCIPLE INVESTIGATOR: PROF. CARLOS BATLLE - MIT

2019 - 2021

- Identified the flexibility requirements for the Saudi power system by simulating different scenarios of renewable energy integration into the generation mix, to ensure the stability of the system
- Proposed a new time of use tariff for the residential sector using an optimization algorithm maximizing the added utility to the consumer and minimizing the added cost to the utility company
- Analyzed the current cost allocation criteria in the Saudi electricity tariff, and proposed a more sophisticated format based on the cost causality principle, sending the desired price signals to the end users

## Disease Spread Simulation Using Agent Based Modeling

KACST

PRINCIPLE INVESTIGATOR: PROF. AHMED ALABDULKAREEM - KACST

2020

- Implemented time series forecasting and imputation for data sets used by the developed model
- Worked on the vectorization of the implemented code reducing the computational time significantly
- Worked on creating a synthesized data set on the workplaces in KSA based on aggregated statistical data

## Construction of an Electrostatic 3D Nano-Printer

Dalhousie

PRINCIPLE INVESTIGATOR: PROF. ALAN FINE - DALHOUSIE

2018

- Constructed a 3D nano-printer that is able to print gold nanodroplets using electrostatic autofocussing to form functional structures as my senior year project at Dalhousie university

## Skills

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<b>Programming Languages</b>	Python, R, C, C++, Visual Basic, Assembly Language, LaTeX
<b>Libraries</b>	Keras, Scikit-Learn, PyTorch, Pyomo, Selenium, Gym
<b>Engineering</b>	Design and Assembly of Electric Circuits, MatLab, Solid Works
<b>Natural Languages</b>	English (proficient), Arabic (native)
<b>Quantitative Reasoning</b>	167 on GRE quantitative Section

## Achievements and Coursework

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- 2022 **Fully funded PhD scholarship for excellent academic performance**, KACST
- 2021 **MS EE Honors program award**, Columbia
- 2020 **Fully funded Master's scholarship for excellent academic performance**, KACST
- 2020 **System Dynamics : Systems Thinking and Modeling for a Complex World**, MIT Sloan, IAP Course
- 2020 **Computational modeling for promoting low-carbon electricity**, MIT IAP Course
- 2020 **Structure and Interpretation of Deep Neural Networks**, MIT IAP Course
- 2018 **DECC Award of Excellence for best scientific poster**, Dalhousie University
- 2018 **2nd place in the IEEE student paper competition**, Dalhousie University
- 2016 **C W Stairs Memorial Scholarship**, Dalhousie University

## Publications

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- [1] **A. Alhadlaq**, B. Alaskar, A. Alabdulkareem, A. Alfadda, P. Duenas, and C. Battle, "Assessing Electricity Tariffs' Costs Allocation in Saudi Arabia: Upcoming Challenges for a Needed Redesign", IEEE Milan PowerTech 2021 *Published*
- [2] B. Alaskar, **A. Alhadlaq**, M. Alharbi, S. Alghumayjan, A. Alabdulkareem, M. Alsaleh, and D. Shah, "Next-day Electricity Demand Forecast: A New Ensemble Recommendation System Using Peak and Valley", IEEE PES ISGT NA 2021 *Published*
- [3] B. Alaskar, **A. Alhadlaq**, A. Alabdulkareem, and A. Alfadda, "On the Optimality of Electricity Tariffs for Saudi Arabia's Residential Sector Considering the Effect of DER", IEEE PES ISGT Europe 2020 *Published*