

Melek Ben-Ayed

Curriculum Vitae

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Education

- 2022 – **PhD in Mechanical and Aerospace Engineering**, *University of California–San Diego (UCSD)*
exp. 2027 Advisor: Professor Jan Kleissl
- 2022 – 2023 **MS in Mechanical and Aerospace Engineering**, *UCSD*
GPA: 3.41
- 2018 – 2022 **BS in Mechanical Engineering**, *University of Kansas (KU)*
GPA: 3.84

Research Interests

- Renewable energy integration
- Electric vehicle (EV) smart charging
- Environmental and energy justice
- Convex optimization
- Reinforcement learning

Publications

- **M. Ben-Ayed**, Z. Zhenhua, J. Nicolas, B. Hwang, T. Dao, J. Cortes, M. Davidson, J. Kleissl and P. Hidalgo-Gonzalez, “**Optimization of DER Planning in Consideration of Environmental Justice**” (*in preparation*)
- **M. Ben-Ayed**, A. Khurram and J. Kleissl, “**A Deep Q-Network Offline Reinforcement Learning Approach for EV Charging Optimization**” (*in preparation*)
- **M. Ben-Ayed**, N. Cardenas-Duran, D. Essa and A. Mispagel, “**Leak Detection Sensor for a Residential Sprinkler**” Senior Mechanical Engineering Project Design Poster Symposium, University of Kansas, April 2022. [Poster presentation]

Research Experience

- Winter 2023 – present ○ **Reinforcement Learning EV Charging**, Professor Kleissl
Creating an Electric Vehicle (EV) smart charging optimization algorithm using Reinforcement Learning (RL) to improve charging efficiency and grid integration
- Fall 2023 – present ○ **Capacity Expansion Model with ERCOT**, Dr. Michael Davidson
Examining the potential impact of the Inflation Reduction Act (IRA) on the Electricity Reliability Corporation of Texas (ERCOT) grid by considering high rates of electrification and EV penetration.
- Fall 2023 – present ○ **†Plug Load Control**, Center for Energy Research, Professor Kleissl
Developed forecasting techniques for water dispenser energy consumption with error <7.8%.
Designing control algorithm to reduce water dispensers’ energy consumption by 70%.
- Spring 2023 – present ○ **DER Planning with Environmental Justice Constraints**, Dr. Patricia Hidalgo-Gonzalez
Developing a model highlighting the significance between equality and equity in energy planning by integrating two utility functions: energy burden and clean energy utility.
- Fall 2022 ○ **HVAC System Controls**, Professor Kleissl
Developed control-oriented models for Heating Ventilation and Air Conditioning systems (HVAC) that characterize HVAC frequency regulation potential.
- Summer 2021 – Spring 2022 ○ **Thermodynamics Pedagogy**, Professor Christopher Depcik
Researched learning difficulties students encounter in Thermodynamics courses and different pedagogical approaches taken by instructors and contributed to writing a paper highlighting a uniform approach to all thermodynamics problems.
- Summer 2021 – Spring 2022 ○ **Artificial Photosynthesis**, Professor Depcik
Performed peer-reviewed research on photocatalytic reduction of CO₂ with H₂O using a TiO₂ catalyst to produce biofuels like CH₄. Developed a detailed rate reaction mechanism and derived the global mechanism to use for simulations.

† Graduate Student Research (GSR) research

Fall 2020 – Spring 2021 ○ **Thermodynamics Modeling**, Professor Depcik
Assimilated the use of CoolProp with Python to develop a MATLAB program that analyzes different fluids for thermodynamic cycles. Developed a tutorial for students to use CoolProp.

Fall 2019 ○ **BioMaterials Modeling**, Professor Candan Tamerler
Researched the mechanical properties of thin films via molecular interactions and using given data, analyzed connections within kinetic models.

Teaching Experience

Spring 2022 ○ **Thermodynamics Supplemental Instructor**, KU Academic Learning Center
Lead discussions over lecture material to review and better prepare students for success in the class.

Fall 2019 – Spring 2020 ○ **Mathematics Tutor**, KU Academic Achievement and Access Center (KU AAAC)
Tutored students in Algebra II, Pre-Calculus, Calculus I, and Calculus II by breaking down complex problems to individual learning levels.

Summer 2020 – Summer 2022 ○ **Midwest Regional Trainer**, Sunrise Movement
Taught sessions with more than 100 community members on the impact of climate change and how to combat climate fallacies. Lead climate justice civil engagement trainings.

Relevant Coursework

- Convex Optimization
- Linear Systems Theory
- Linear Control Design
- Nonlinear Systems Theory
- Electric Power Systems Modeling

Skills

Programming MATLAB, Python, Julia
Optimization CVX, JuMP, Gurobi
RL Stable Baselines3 (SB3), d3rlpy (offline RL)
Modeling SolidWorks, MSC Adams, MSC Patran
Languages Native Arabic, Native English, Elementary French

Community Service and Leadership

Fall 2023 – present ○ **Chair**, Mechanical Engineering Graduate Student Council, *UCSD*
Taught sessions with more than 100 community members on the impact of climate change and how to combat climate fallacies. Lead climate justice civil engagement trainings.

Fall 2019 – Winter 2022 ○ **President**, American Society of Mechanical Engineers, *KU*
Revitalized the organization by increasing membership from 5 to 80 students through new initiatives. Created Technical Division Committees (BioMechanical, Manufacturing, Advanced Energy) to provide students an opportunity to explore different industries.

Winter 2020 – Spring 2022 ○ **Chair**, Mechanical Engineering Student Advisory, *KU*
Worked with student representatives to foster increase academic ethical behavior. Authored the first ‘Honor Code’ in the KU Mechanical Engineering Department.

Fall 2020 – Spring 2021 ○ **Chair**, Student Environment Advisory Board, *KU*
Developed policies and formulated strategies to enhance environmental programs by teaming up with students, staff, and faculty throughout campus.

Awards & Honors

Rhodes Scholarship nominee (*KU*, 2022), Marshall Scholarship nominee (*KU*, 2022), Mitchell Scholarship nominee (*KU*, 2022), Udall Fellowship nominee (*KU*, 2021), Harry Lindquist Award (*KU*, 2021), Pi Tau Sigma (*KU*, 2021), Tau Beta Pi (*KU*, 2021), Michael Shahan Scholarship (*American School of Doha*, 2018), President’s Education Award (*American School of Doha*, 2018), Most Outstanding Scout Award (*Tunisian National Scouts*, 2016)