

Curriculum Vitae

Mohamed El Mistiri

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Education

Ph.D., Chemical Engineering, Arizona State University, May 2024 (GPA: 4.00/4.00).

Dissertation Title: System Identification and Control Systems Engineering Approaches for Optimal and Practical Personalized mHealth Interventions for Physical Activity (*2024 Dean's Dissertation Award winner*)

<https://hdl.handle.net/2286/R.2.N.193656>

Dissertation Advisor: Professor Daniel E. Rivera

M.S., Chemical Engineering, Arizona State University, December 2023 (GPA: 4.00/4.00).

Advisor: Professor Daniel E. Rivera

B.S., Chemical Engineering (Summa Cum Laude), Arizona State University, May 2017 (GPA: 3.86/4.00).

Research/Teaching Experience

Interactive Robotics Laboratory (IRL)

Tempe, AZ

Postdoctoral Research Scientist

January 2025 – present

- Investigated the application of LLMs as natural language-driven optimizers for robotic task learning (Python).
- Developed a novel approach integrating LLM-based optimization with MPC for trajectory planning in robotic arm control.

Control Systems Engineering Lab (CSEL)

Tempe, AZ

Graduate Research Associate

January 2020 – December 2024

Collaborated with behavioral scientists, computer scientists, and engineers in large multidisciplinary teams to develop novel behavioral interventions. Built tools to design and execute experiments, monitor, and analyze the data. Applied computational modeling, model-based predictive control, data science, and optimization principles to develop data-driven control schemes and evaluate their performance and applications in diverse settings including healthcare. Led lab efforts on multiple NIH-funded studies and summarized progress and findings into reports, publications, and presentations. Activities included:

1. *JustWalk Just-In-Time Adaptive Intervention (JITAI)*: (NIH Grant R01LM013107)
 - Designed innovative input signals in DoE to yield informative datasets for behavior change associated with walking.
 - Devised data-centric signal processing and model estimation algorithms to estimate nonlinear models in behavior change systems with high predictive ability, outperforming traditional methods.
 - Developed information and decision computer infrastructure for a fully automated intervention delivery.
2. *Control Optimization Trial (COT): YourMove*: (NIH Grant R01CA244777)
 - Applied *a priori* knowledge to improve DoE and developed computational dynamic models for a first-of-its-kind closed-loop large-scale behavioral interventions with 198+ participants.
 - Enhanced Hybrid Model Predictive Control (HMPC) algorithm and closed-loop control strategies and evaluate performance in simulations ahead of clinical implementation.
 - Utilized stochastic search methods to optimize feature and order selection in dynamic model estimation, reducing computation time from 1 hour to 20 minutes.
 - Attained 100% automation of the system to deliver behavioral interventions on a large scale.

3. *HeartSteps II*: (NIH Grant U01CA229445)

- Collaborated with behavioral scientists on the team to develop a first principles model describing participant engagement in the intervention.
- Validated aspects of the hypothesized model through a black-box model estimation approach.
- Investigated applying a Bayesian inference model-based approach for data imputation, illustrating the added benefit of propagating uncertainty due to missingness.

Arizona State University

Tempe, AZ

Graduate Teaching Assistant: ChE 461 Process Dynamics and Control August – December 2020

- Sole teaching assistant for 150 students.
- Assisted students in improving their mastery of concepts related to dynamic modeling and control systems design, including the utilization of MATLAB/Simulink to model systems and test controller design.
- Demonstrated leadership and interpersonal skills by leading office hours, providing review sessions ahead of exams and one-on-one interactions with students.
- Awarded Outstanding Chemical Engineering TA as part of the 2021 SEMTE Celebration of Excellence at ASU.

Undergraduate Teaching Assistant: ChE 442 Reactor Design

January – May 2017

- Assisted students in improving their mastery of concepts related to chemical reactions and reactor design.
- Hosted office hours to answer group and individual questions.
- Demonstrated leadership and interpersonal skills by providing extra review sessions ahead of exams based on students' needs and interest.

Undergraduate Teaching Assistant: FSE 100 Introduction to Engineering August – December 2016

- Aided students in understanding principles of engineering design.
- Managed lab sessions, supervised, and assisted students with power tools.
- Hosted lecture sessions on a few occasions.

Industrial Experience

Third Evolution Inc.

Scottsdale, AZ

Process Engineer

July 2017 – June 2019

- Led the contract for equipment integration and maintenance of water and wastewater treatment plants in Tacoma, WA.
- Characterized production anomalies, determined root causes, devised design improvements to address them, evaluated risk of implementation, and supervised their successful implementation in the field (doubling processing capacity in some cases).
- Analyzed PID feedback control loops on-site and adjusted tuning parameters, which reduced oscillations by 20% (PLCs).
- Evaluated chemical processes to identify ways to optimize performance, which improved yield by approximately 10%.
- Collaborated with engineers on-site to generate SOPs and train operators, which reduced turnaround time by 25%.
- Inspected facilities and implemented changes to ensure 100% compliance with safety and environmental regulations.
- Generated technical reports and submitted them to the EPA, which successfully passed compliance.

Areas of Research

Control Systems Engineering with emphasis on system identification, dynamic modeling, optimization of advanced control strategies, and integration with machine learning for applications in robotics, healthcare, autonomous systems, process control, supply chain management, and preventive medicine.

Projects

Stochastic Optimization: Renewable Energy Electric Grid Optimization Fall 2022

- Formulated a stochastic optimization objective function to ensure electric power generation from a grid of renewable resources meets demand under uncertainty conditions.
- Developed Progressive Hedging (PH) and Randomized Progressive Hedging (RPH) code on MATLAB to evaluate their performance in solving the problem.
- The developed RPH algorithm performed 1.75 times faster than PH when 32 possible scenarios were considered.

Decentralized Control: Smart Grid Optimization Fall 2022

- Investigated a novel real-time pricing algorithm in a smart electric grid problem.
- Implemented dual decomposition optimization on MATLAB, as a part of the real-time pricing algorithm.
- Evaluated the performance of the algorithm in comparison to fixed pricing in a simulation setting.

AI & Optimization: NeuroEvolution of Augmenting Topology (NEAT) Algorithm Spring 2022

- Collaborated on GitHub with a team of two classmates to develop a repository for the NEAT algorithm on Python.
- Implemented the NEAT algorithm to build and train neural network models on classical control problems offered by OpenAI.
- Documented and presented the NEAT algorithm's performance against common NN structures (SLP, MLP, RNN).

Nonlinear System Control: Autonomous Quadcopter Drone Landing Fall 2021

- Developed model-based control algorithms and strategies to overcome the nonlinearities associated with the ground effect for automated quadrotor drone landing.
- Utilized MATLAB/Simulink Aerospace toolbox to simulate the quadcopter drone landing, including ground effect.
- Evaluated the performance of the developed control algorithms in simulations of the improved kinematic model.
- Achieved successful landing 25% faster than traditional PID control and eliminated oscillations that can damage the drone.

Chemical Reactor Design: CSTR in Series Fall 2020

- Optimized design parameters of a series of Continuously Stirred Tank Reactors (CSTR) on COMSOL, to improve yield.
- Designed a 3-degrees-of-freedom PID feedback controller for the CSTR system.
- Applied sensitivity analysis on design and tuning parameters to ensure controller robustness and safety of the reactor system.

Capstone Design Project: Low Carbon Emission SMR Hydrogen Production Spring 2017

- Designed a carbon and energy efficient large-scale plant for mass production of Hydrogen (120 MM SCFD).
- Integrated Steam Methane Reforming (SMR) & Water Gas Shift (WGS) reactors to efficiently produce Hydrogen from Desulfurized Natural Gas (DNG).
- Utilized a two-stage pressure swing adsorption (PSA) separation process to purify the produced Hydrogen and capture Carbon Dioxide, reaching 99.9% purity with 90% recovery.
- Reduced energy consumption of the process through heat integration with a nuclear plant nearby.
- Performed cost analysis on the proposed design for cases related to possible carbon capture incentives to validate the design and predict profitability in each scenario.

System Identification: Control Relevant Model Estimation in High-Order Systems Spring 2017

- Applied control relevant input signal design to generate dynamically informative data of a high-order system
- Utilized the data to estimate a reduced order control relevant error-predictive model.
- Evaluated the performance of the reduced order model in closed-loop feedback control in a simulation environment using MATLAB.

- Collaborated with a team of three classmates to design and simulate process controls for thin-film manufacturing.
- Examined different thin-film manufacturing processes and found Atomic Layer Deposition (ALD) to be the most efficient for the project, to meet the desired critical dimensions.
- Built MATLAB/Simulink scripts/models to simulate the process under various conditions, based on first-principal models.
- Designed a 2-degree PID controller based on Internal Model Control, to achieve intuitive tuning.
- Performed sensitivity analysis on the designed controller, to meet desired feedback control response and ensure robustness.

Awards, Honors, and Memberships

- Dean's Dissertation Award ASU, 2024.
- Outstanding Graduate Accomplishment Award, Spring 2024.
- Outstanding Chemical Engineering Teaching Assistant: SEMTE Celebration of Excellence at ASU, Spring 2021.
- Most Innovative Design Award for ChE 462, Capstone Design Project: Low Carbon Emissions SMR Hydrogen production, ASU Spring 2017.
- Dean's List: Qatar University Fall 2013, Spring 2014, & Fall 2014 / ASU Spring 2015, Summer 2015, Fall 2015, Summer 2016, & Spring 2017.
- Student member of the American Institute of Chemical Engineers (AIChE).
- Student member of the Institute of Electrical and Electronics Engineers (IEEE).
- Member of the Engineering Honors Society Tau Beta Pi.

Publications

Refereed Archival Journals

1. Donna Spruijt-Metz, Benjamin M Marlin, Misha Pavel, Daniel E Rivera, Eric Hekler, Steven De La Torre, **Mohamed El Mistiri**, Natalie M Golaszweski, Cynthia Li, Rebecca Braga De Braganca et al. (2022). "Advancing behavioral intervention and theory development for mobile health: the HeartSteps II protocol". Em: *International journal of environmental research and public health* 19.4, p. 2267
2. Daniel Cevallos, César A Martín, **Mohamed El Mistiri**, Daniel E Rivera e Eric Hekler (2022). "Un esquema de decisiones para intervenciones adaptativas comportamentales de actividad física basado en control predictivo por modelo híbrido: ilustración con Just Walk". Em: *Revista iberoamericana de automatica e informatica industrial* 19.3. (**Joint First Authorship**), p. 297
3. Junghwan Park, Meelim Kim, **Mohamed El Mistiri**, Rachael Kha, Sarasij Banerjee, Lisa Gotzian, Guillaume Chevance, Daniel E Rivera, Predrag Klasnja, Eric Hekler et al. (2023). "Advancing understanding of just-in-time states for supporting physical activity (Project JustWalk JITAI): protocol for a System ID study of just-in-time adaptive interventions". Em: *JMIR Research Protocols* 12.1, e52161
4. Steven De La Torre, **Mohamed El Mistiri**, Eric Hekler, Predrag Klasnja, Benjamin M. Marlin, Misha Pavel, Donna Spruijt-Metz e Daniel E. Rivera (2024). "Modeling engagement with a digital behavior change intervention (HeartSteps II): An exploratory system identification approach". Em: *Journal of Biomedical Informatics* 158, p. 104721. ISSN: 1532-0464. DOI: doi.org/10.1016/j.jbi.2024.104721
5. **Mohamed El Mistiri**, Owais Khan, César A. Martin, Eric Hekler e Daniel E. Rivera (2025). "Data-Driven Mobile Health: System Identification and Hybrid Model Predictive Control to Deliver Personalized Physical Activity Interventions". Em: *IEEE Open Journal of Control Systems* 4, pp. 83–102. DOI: 10.1109/OJCSYS.2025.3538263

6. **Mohamed El Mistiri**, Daniel E. Rivera, Predrag Klasnja, Junghwan Park e Eric Hekler (2025). “Model predictive control in mHealth: a decision framework for optimised personalised physical activity interventions”. Em: *International Journal of Control*, pp. 1–17. DOI: 10.1080/00207179.2025.2491109
7. Owais Khan, **Mohamed El Mistiri**, Sarasij Banerjee, Eric Hekler e Daniel E. Rivera (2025). “3DoF-KF HMPC: A Kalman filter-based Hybrid Model Predictive Control Algorithm for Mixed Logical Dynamical Systems”. Em: *Control Engineering Practice* 154, p. 106171. ISSN: 0967-0661. DOI: doi.org/10.1016/j.conengprac.2024.106171
8. Sarasij Banerjee, Owais Khan, **Mohamed El Mistiri**, Naresh N. Nandola, Eric Hekler e Daniel E. Rivera (2025). “Data-Driven Control of Nonlinear Process Systems Using a Three-Degree-of-Freedom Model-on-Demand Model Predictive Control Framework”. Em: *Industrial & Engineering Chemistry Research* 64.17, pp. 8847–8864. DOI: 10.1021/acs.iecr.4c04583
9. Banerjee, S., **M. El Mistiri**, O. Khan, E. Hekler, and D. E. Rivera. “Model-On-Demand Estimation and 3DoF-KF Model Predictive Control: Application to the SIR Epidemic Model,” **(In Preparation)**
10. Kim, M, S. Assi, **Mohamed El Mistiri**, J. Park, S. Banerjee, D. E. Rivera, P. Klasnja, and E. Hekler. “Optimizing and Validating Individualized and Adaptive mHealth Digital Health Interventions via Control Systems Engineering Methods: Protocol of a Randomized Controlled Trial,” *Journal of Medical Internet Research (JMIR)*. **(In Review)**
11. **El Mistiri, M.**, S. De La Torre, K. Tung, B. Marlin, M. Pavel, P. Klasnja, D. Spruijt-Metz, an D. E. Rivera. “System Identification of Engagement in mHealth Intervention with a Bayesian Approach for Missing Data Imputation,” *Control Engineering Practice*. **(In Review)**

Refereed Conference Proceedings

1. **Mohamed El Mistiri**, Daniel E Rivera, Predrag Klasnja, Junghwan Park e Eric Hekler (2022b). “Model predictive control strategies for optimized mhealth interventions for physical activity”. Em: *2022 American Control Conference (ACC)*. IEEE, pp. 1392–1397. DOI: 10.1109/CDC51059.2022.9992932
2. **Mohamed El Mistiri**, Daniel E Rivera, Predrag Klasnja, Junghwan Park e Eric Hekler (2022a). “Enhanced social cognitive theory dynamic modeling and simulation towards improving the estimation of “just-in-time” states”. Em: *2022 American Control Conference (ACC)*. IEEE, pp. 468–473. DOI: 10.23919/ACC53348.2022.9867493
3. Owais Khan, **Mohamed El Mistiri**, Daniel E Rivera, César A Martin e Eric Hekler (2022). “A Kalman filter-based hybrid model predictive control algorithm for mixed logical dynamical systems: Application to optimized interventions for physical activity”. Em: *2022 IEEE 61st Conference on Decision and Control (CDC)*. IEEE, pp. 2586–2593. DOI: 10.1109/CDC51059.2022.9992932
4. Daniel E. Rivera, **Mohamed El Mistiri** e Z. Shi (2022). “Using SIR Epidemic Modeling and Control to Teach Process Dynamics and Control to Chemical Engineers”. Em: *IFAC-PapersOnLine* 55.17. 13th IFAC Symposium on Advances in Control Education ACE 2022, pp. 380–385. ISSN: 2405-8963. DOI: doi.org/10.1016/j.ifacol.2022.09.309
5. Karine Tung, Steven De La Torre, **Mohamed El Mistiri**, Rebecca Braga De Braganca, Eric Hekler, Misha Pavel, Daniel Rivera, Pedja Klasnja, Donna Spruijt-Metz e Benjamin M Marlin (2022). “BayesLDM: A Domain-specific Modeling Language for Probabilistic Modeling of Longitudinal Data”. Em: *2022 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*. IEEE, pp. 78–90
6. **Mohamed El Mistiri**, Owais Khan, Daniel E Rivera e Eric Hekler (2023). “System identification and hybrid model predictive control in personalized mHealth interventions for physical activity”. Em: *2023 American Control Conference (ACC)*. IEEE, pp. 2240–2245. DOI: 10.23919/ACC55779.2023.10156652

7. D E. Rivera, S Banerjee, C Kobs, **Mohamed El Mistiri** e Z Shi (2024). “SIR Epidemic Control Using a 2DoF IMC-PID with Filter Control Strategy”. Em: *IFAC-PapersOnLine* 58.7, pp. 204–209. DOI: doi.org/10.1016/j.ifacol.2024.08.035
8. **Mohamed El Mistiri**, Steven De La Torre, Karine Tung, Benjamin M Marlin, Misha Pavel, Predrag Klasnja, Donna Spruijt-Metz e Daniel E Rivera (2024). “System Identification of User Engagement in mHealth Behavioral Interventions”. Em: *IFAC-PapersOnLine* 58.15, pp. 508–513. DOI: doi.org/10.1016/j.ifacol.2024.08.580
9. **Mohamed El Mistiri**, Sarasij Banerjee, Daniel E. Rivera, Predrag Klasnja, Junghwan Park e Eric Hekler (2024). “Understanding “Just-in-Time” States in Behavioral Interventions using System Identification and Data Science Methods”. Em: *IFAC-PapersOnLine* 58.15. 20th IFAC Symposium on System Identification SYSID 2024, pp. 568–573. ISSN: 2405-8963. DOI: doi.org/10.1016/j.ifacol.2024.08.590
10. Sarasij Banerjee, Pablo Otálora, **Mohamed El Mistiri**, Owais Khan, José Luis Guzmán e Daniel E. Rivera (2024). “Control-Relevant Input Signal Design For Integrating Processes: Application to a Microalgae Raceway Reactor”. Em: *IFAC-PapersOnLine* 58.15. 20th IFAC Symposium on System Identification SYSID 2024, pp. 360–365. ISSN: 2405-8963. DOI: doi.org/10.1016/j.ifacol.2024.08.555
11. Sarasij Banerjee, Owais Khan, **Mohamed El Mistiri**, Naresh N. Nandola e Daniel E. Rivera (2024). “Data-Driven Control of Highly Interactive Systems using 3DoF Model-On-Demand MPC: Application to a MIMO CSTR”. em: *IFAC-PapersOnLine* 58.15. 20th IFAC Symposium on System Identification SYSID 2024, pp. 420–425. ISSN: 2405-8963. DOI: doi.org/10.1016/j.ifacol.2024.08.565

Conference Presentations

1. El Mistiri, Mohamed. “Enhanced Social Cognitive Theory Dynamic Modeling and Simulation Towards Improving the Estimation of ‘Just-In-Time’ States,” 2022 American Control Conference (ACC), Atlanta, GA, June 8, 2022.
2. El Mistiri, Mohamed. “Model Predictive Control Strategies for Optimized mHealth Interventions for Physical Activity,” 2022 American Control Conference (ACC), Atlanta, GA, June 8, 2022.
3. El Mistiri, Mohamed. “An Integrated System Identification and Hybrid Model Predictive Control Strategy for Optimized Interventions for Physical Activity,” 2022 AIChE Annual Meeting, Phoenix, Arizona, Nov. 16, 2022.
4. El Mistiri, Mohamed. “Experimental Design for Estimating “Just-in-Time” States in Control-Oriented Behavioral Interventions for Physical Activity,” 2022 AIChE Annual Meeting, Phoenix, Arizona, Nov. 18, 2022.
5. El Mistiri, Mohamed. “System Identification and Hybrid Model Predictive Control in Personalized mHealth Interventions for Physical Activity,” 2023 American Control Conference (ACC), San Diego, CA, June 1, 2023.
6. El Mistiri, Mohamed. “System Identification of User Engagement in mHealth Behavioral Interventions,” *IFAC Symposium on System Identification (SYSID 2024)*, Boston, MA, USA, July 18, 2024.
7. El Mistiri, Mohamed. “Understanding ‘Just-in-Time’ States in Behavioral Interventions using System Identification and Data Science Methods,” *IFAC Symposium on System Identification (SYSID 2024)*, Boston, MA, USA, July 18, 2024.