Exponent®
Engineering & Scientific Consulting

Mohammad Freigoun, Ph.D.

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Professional Profile

Dr. Freigoun is a decision optimization scientist specializing in modeling causal, data-generating dynamical systems, including linear, nonlinear, and hybrid, mixed logical dynamical systems. He offers expertise in both open- and closed-loop system identification, encompassing model estimation algorithms, parsimonious modeling (i.e., model reduction) techniques, model validation, input signal design, time- and frequency-domain analysis, and digital signal processing.

Dr. Freigoun's background and interests also span advanced process control and automation, including predictive control (MPC/HMPC), optimal control (LQR/LQG), IMC controller design and tuning rules, LMI controller synthesis, robust control and loop shaping, and state observers. He has delivered adaptive solutions to client and partner challenges by reformulating them as constrained decision problems amenable to state-of-the-art optimization solvers. His previous projects include designing an end-to-end adaptive supply chain optimization algorithm, as well as advancing the design of personalized behavioral medicine interventions deployed via mobile health (mHealth) technologies.

Additionally, Dr. Freigoun brings over 10 years of technical experience in dynamic modeling and optimization software development environments, including IDEs and languages such as MATLAB & Simulink, Python, AMPL (CPLEX, GUROBI, XPRESS, SCIP, Knitro, etc.), COMSOL Multiphysics, SQL, and .NET. He also utilizes High Performance Computing (HPC) clusters to execute efficient parallel computing algorithms for extensive modeling, simulations, and data analysis.

At Exponent, Dr. Freigoun is dedicated to maximizing client productivity through process optimization, product design and testing, data science, risk management, quality control and assurance, and digital transformation. He supports partners across various projects by leveraging his expertise in approaching large-scale decision problems and high-complexity engineering design challenges via dynamic modeling, mathematical programming, uncertainty/sensitivity analysis, and machine learning methods.

Dr. Freigoun received his Ph.D. in Chemical Engineering from Arizona State University, specializing in developing and applying advanced system identification and control systems engineering algorithms and principles in mHealth technologies. His research contributions included the development of a convexification framework for estimating grey-box state-space models of linear and quadratic structures.

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, Arizona State University, 2021

Engineering Graduate Fellowship, Arizona State University, 2021

American Control Conference & ASU Graduate College Travel Awards, 2017

Tau Beta Pi Association, ASU Chapter, 2016

Outstanding Teaching Assistant Award, School for Engineering of Matter, Transport & Energy, Arizona State University, 2016

Outstanding Employee, Tabuk Pharmaceuticals Manufacturing Company, 2013

Prior Experience

Modeling Engineer, OptimaDesign Consulting, 2021-2023

Product Manager, Modeling & AI, Cancer Fund Impact Investments, 2019-2021

Consultant/Research Associate, Pennsylvania State University, 2017-2018

Graduate Research Associate, Arizona State University, 2015-2017

Graduate Teaching Associate, Arizona State University, 2015-2016

Planning Engineer, Tabuk Pharmaceuticals Manufacturing Company, 2012-2013

Professional Affiliations

Institutes of Electrical and Electronics Engineers — IEEE

Publications

Freigoun MT, Tsakalis KS, Raupp GB. A spectral decomposition identification algorithm for structured state-space models: Estimating semiphysical models of social cognitive theory. IEEE American Control Conference (ACC) 2021; 2836–2841.

Freigoun MT, Tsakalis KS, Raupp GB. On the identification of social cognitive theory models and closed-loop intervention simulations using hybrid model predictive control. IFAC-PapersOnLine 2021; 54(7):31–36.

dos Santos PL, Freigoun MT, Martín CA, Rivera DE, Hekler EB, Romano RA, Perdicoúlis TP. System identification of Just Walk: using matchable-observable linear parametrizations. IEEE Transactions on Control Systems Technology 2018; 28(1):264-75.

Freigoun MT, Rivera DE, Guo P, Hohman EE, Gernand AD, Symons Downs D, Savage JS. A dynamical systems model of intrauterine fetal growth. Mathematical and Computer Modelling of Dynamical Systems 2018; 24(6):661–687.

Hekler EB, Rivera DE, Martin CA, Phatak SS, Freigoun MT, Korinek E, Klasnja P, Adams MA, Buman MP. Tutorial for using control systems engineering to optimize adaptive mobile health interventions. Journal of Medical Internet Research 2018; 20(6).

Phatak SS, Freigoun MT, Martín CA, Rivera DE, Korinek EV, Adams MA, Buman MP, Klasnja P, Hekler EB. Modeling individual differences: A case study of the application of system identification for personalizing a physical activity intervention. Journal of Biomedical Informatics 2018; 79:82–97.

Korinek EV, Phatak SS, Martin CA, Freigoun MT, Rivera DE, Adams MA, Klasnja P, Buman MP, Hekler EB. Adaptive step goals and rewards: A longitudinal growth model of daily steps for a smartphone-based walking intervention. Journal of Behavioral Medicine 2018; 41:74–86.

dos Santos PL, Freigoun MT, Rivera DE, Hekler EB, Martín CA, Romano R, Perdicoúlis TP, Ramos JA. A MoliZoft system identification approach of the just walk data. IFAC-PapersOnLine 2017; 50(1):12508–12513.

Freigoun MT, Martín CA, Magann AB, Rivera DE, Phatak SS, Korinek EV, Hekler EB. System identification of Just Walk: A behavioral mHealth intervention for promoting physical activity. IEEE American Control Conference (ACC) 2017; 116–121.

Presentations

Phatak SS, Hekler EB, Martin CA, Rivera DE, Freigoun MT. Just Walk Study: Building a dynamical model to predict “ambitious but doable” daily step goals. Symposium, Society of Behavioral Medicine Conference, Washington, D.C., 2016.

Savage JS, Downs DS, Freigoun MT, Guo P, Rivera DE. Using dynamical systems modeling to understand the effects of the intrauterine environment on fetal growth. Poster presentation, The Obesity Society, New Orleans, LA, 2016.

Freigoun MT, Guo P, Rivera DE, Hohman E, Pauley A, Downs DS, Savage JS. A dynamical systems model for understanding how the intrauterine environment affects fetal growth in an intervention context. Poster presentation, Society of Behavioral Medicine, 38th Annual Meeting & Scientific Sessions, San Diego, CA, 2017.

Peer Reviews

IFAC Symposium on System Identification

IFAC Conference on Advances in Proportional-Integral-Derivative (PID) Control

IFAC Symposium on Advances in Control Education