# Joseph Costandy

(979) 213-2914 | joecostandy@utexas.edu

## OBJECTIVE

Seeking a full-time position starting May 2021 in process systems engineering, machine learning/data analytics, mathematical modeling, process control and optimization, or related fields.

## EDUCATION

**PhD Candidate, Chemical Engineering, The University of Texas at Austin**
Graduating May 2021, Overall GPA: 3.86/4.00
Recipient of the Dr. Robert Schechter Endowed Excellence Fund in Chemical Engineering

**M. Sc. (with thesis), Chemical Engineering, Texas A&M University at Qatar**
Graduated May 2015, Overall GPA: 3.72/4.00

**B. Sc., Chemical Engineering, Texas A&M University at Qatar**
Graduated May 2013, Overall GPA:3.60/4.00

## AWARDS AND HONORS

- *Best Graduate Student Paper Award*, The McKetta Department of Chemical Engineering, 2018
- *Outstanding Service to the Department of Chemical Engineering Award*, Texas A&M University, 2016
- *Richard E. Ewing Excellence in Student Research Award*, Texas A&M University at Qatar, 2015
- *Inaugural President,* Omega Chi Epsilon – Qatar Chapter, Texas A&M University at Qatar, 2012 – 2014

## SKILLS

**Research Areas**
Process Systems Modeling, Simulation, and Optimization; Machine Learning; Data Science; Statistical Analysis; Process Control

**Computational Tools**
Matlab, Fortran, Python, C++, Linux, Aspen Plus, gPROMS, GAMS, parallel computing, MS Office, Latex

**Languages**
English (Bilingual proficiency), Arabic (native)

## EXPERIENCE

**Graduate Research Assistant, The University of Texas at Austin, 01/2017 – Present**
Advisors: Dr. Michael Baldea, Dr. Thomas Edgar

- Developed systematic optimization frameworks for batch to continuous transition of chemical processes
    - Identified and exploited mathematical similarities between the two fundamental operating modes
    - Unified the economic description of the operating modes
    - Generalized approach to accommodate the optimization of any chemical system
- Formulated a general optimization framework for economic evaluation of process control performance
    - Defined and demonstrated the use of transition time as an economic metric for transient processes

**Graduate Research Assistant, Texas A&M University, 08/2015 – 12/2017**
Advisor: Dr. Christodoulos Floudas (deceased)

- Designed and optimized novel hybrid feedstock energy processes with negative carbon emissions
- Formulated a predictive algorithm that utilizes published data of lab-scale state-of-the-art electrolyzers to forecast the cost of a potential future industrial-scale electrolyzer unit

**Graduate Research Assistant (M. Sc.), Texas A&M University at Qatar, 05/2013 – 05/2015**
Advisor: Dr. Ioannis Economou

- Performed molecular and continuum scale modeling and simulation of gas hydrate systems

**Intern, Qatar Petrochemical Company, 05/2012 – 08/2012**

- Utilized available plant data to tune LDPE plant model parameters
- Optimized plant operating conditions and presented findings to company management

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**Undergraduate Researcher, Texas A&M University at Qatar, 08/2010 – 05/2012**

- Led a Computational Fluid Dynamics (CFD) team in the simulation of hydrogen-producing solar reactors
- Assessed the potential of advanced reduction methods in the treatment of harmful pesticides

## JOURNAL PUBLICATIONS (FIRST AUTHOR)

- **Costandy, J.**, Edgar, T. F., & Baldea, M. (in prep). Batch and Continuous Reactor Network Synthesis, Optimization, and Intensification via Unified Optimization Framework.
- **Costandy, J.**, Edgar, T. F., & Baldea, M. (in prep). Biodiesel Plant Design and Optimization Simultaneously Considering Batch And Continuous Design Alternatives.
- **Costandy, J.**, Edgar, T. F., & Baldea, M. (2019). Switching from Batch to Continuous Reactors is a Trajectory Optimization Problem. *Industrial and Engineering Chemistry Research*, 58, 13718 – 13736.
- **Costandy, J.**, Edgar, T. F., & Baldea, M. (2018). A Scheduling Perspective on the Monetary Value of Improving Process Control. *Computers and Chemical Engineering*, 112, 121 – 131.
- **Costandy, J.**, Michalis, V. K., Tsimpanogiannis, I., Stubos, A. K., & Economou, I. G. (2016). Molecular Dynamics Simulations of Pure Methane and Carbon Dioxide Hydrates. Lattice Constants and Derivative Properties. *Molecular Physics*, 114, 2672 – 2687.
- **Costandy, J.**, Michalis, V. K., Tsimpanogiannis, I., Stubos, A. K., & Economou, I. G. (2016). Lattice constants of pure methane and carbon dioxide hydrates at low temperatures. Implementing quantum corrections to classical molecular dynamics studies. *The Journal of Chemical Physics*, 144, 124512.
- **Costandy, J.**, Michalis, V. K., Tsimpanogiannis, I., Stubos, A. K., & Economou, I. G. (2015). The role of intermolecular interactions in the prediction of the phase equilibria of carbon dioxide hydrates. *The Journal of Chemical Physics*, 143, 094506.
- **Costandy J** *et al*. Effect of reactor geometry on the temperature distribution of hydrogen producing solar reactors. International Journal of Hydrogen Energy (2012), 37, 16581 – 16590.

## NOTABLE COURSEWORK

- *Data Science Lab,* course on building models to perform prediction and inference in Python. Topics included predictive modeling, regression and classification, data cleaning and preprocessing, feature engineering, unsupervised methods, PCA, data clustering, model and feature selection, and neural networks.
- *Stochastic Systems Estimation and Control,* course on the theory and practice of stochastic systems. Topics included deterministic modeling, probability theory, time and spectral methods, Monte Carlo methods, Kalman filters, linear and nonlinear systems, and practical applications of random and uncertain systems.
- *Applied Probability*, course on probability and statistics. Topics included probability theory, combinatorial analysis of random phenomena, conditional probability and independence, parametric families of distributions, expectation, distribution of functions of random variables, and limit theorems.
- *Linear Programming* (LP), course on the mathematics and algorithms associated with LP. Topics included LP theory and algorithms (e.g. simplex methods, integer programming), formulating models and solving practical problems using advanced optimization software.
- *Nonlinear Mixed Integer Global Optimization (MINLP)*, course on construction and solution of MINLPs. Topics included convex analysis, constrained and unconstrained problems, duality theory, modeling for continuous and integer problems, solution methods for global optimization of MINLPs.
- *Process Synthesis, Integration, and intensification*, course on systematic approaches for chemical process synthesis, integration and intensification for static and dynamic chemical processes. Topics included constrained and unconstrained optimization, continuous and integer problems, operability analysis, and multi-parametric model predictive control.
- *Optimal Control Theory*, course on the theory and practice of modern optimal control systems. Topics included calculus of variations, necessary and sufficient conditions for optimality, Pontryagin's maximum principle, minimum-time control, and dynamic programming.