

# Carlos Felipe **Alcala Perez**

Milwaukee, WI. | ☎ (+1) 414-426-6814 | ✉ [alcala21@gmail.com](mailto:alcala21@gmail.com) | 🏠 [www.alcala21.org](http://www.alcala21.org) | 📷 [alcala21](#) | 🌐 [alcala21](#) | 🎓 Carlos F. Alcala

## Research Engineer

### Summary

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Accomplished Research Engineer with extensive experience developing and implementing data-driven and machine learning solutions in the Building Efficiency and Chemical industries. Highly skilled in the analysis, development, deployment and documentation of research solutions. Award winning scholar with multiple patents and research articles.

### Expertise

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- Research and Development
- Control Systems
- Machine Learning
- Multivariate Statistical Analysis
- Data Analytics and Visualization
- Software Development

### Experience

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#### Johnson Controls

Oct. 2011 - Jan. 2020

##### PRINCIPAL RESEARCH ENGINEER

Milwaukee, WI

Dec. 2017 - Jan. 2020

- Utilized advanced optimization and data analytics methods to improve the efficiency of heating, ventilation and air conditioning (HVAC) systems.
- Key role in the transfer of newly developed technology into products and applications.
- Multiple patents granted.

##### SENIOR RESEARCH ENGINEER

Milwaukee, WI

May 2015 - Dec. 2017

- Developed methods for monitoring the performance of PID controllers, to detect steady state operation of HVAC equipment, and reduce energy consumption in wireless thermostats while keeping acceptable comfort standards. Applied advanced mathematical tools to develop these methods, as well as artificial intelligence, machine learning and traditional statistical methods.

##### SENIOR RESEARCH ENGINEER

Mexico City, Mexico

Jan. 2013 - May 2015

- Developed data-driven methods for fault detection and diagnosis in connected chillers.

##### SENIOR RESEARCH ENGINEER

Milwaukee, WI

Oct. 2011 - Jan. 2013

- Developed a method for adaptive sampling of PID controllers.

### Internship Experience

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#### The Dow Chemical Company

Freeport, TX

May 2010 - Aug. 2010

##### SUMMER RESEARCH INTERN

- Developed an Excel application for multivariate statistical monitoring of continuous and batch processes.

#### Capstone Technology

Seattle, WA

2006 - 2009

##### SUMMER ENGINEERING INTERN

May. 2009 - Aug. 2009

- Developed a multivariate image analysis application to monitor combustion efficiency in furnaces.

##### SUMMER ENGINEERING INTERN

May. 2007 - Aug. 2007

- Developed a multivariate statistical application for statistical modeling and prediction in chemical processes.

##### SUMMER ENGINEERING INTERN

May. 2006 - Aug. 2006

- Developed a multivariate statistical application for detection and diagnosis of sensor and process faults.

- Developed a multivariate statistical application for monitoring the operation of a semiconductor manufacturing process.

## Education

### Doctor of Philosophy in Chemical Engineering

Los Angeles, CA

Aug. 2007 - Aug. 2011

UNIVERSITY OF SOUTHERN CALIFORNIA

- Awarded a Roberto Rocca Fellowship.

### Master of Science in Chemical Engineering

Austin, TX

Aug. 2005 - May 2007

THE UNIVERSITY OF TEXAS AT AUSTIN

- Fulbright Scholarship Recipient.

### Bachelor of Science in Chemical Engineering, summa cum laude

Ciudad Madero, Mexico

Aug. 1999 - Dec. 2003

INSTITUTO TECNOLÓGICO DE CIUDAD MADERO

## Skills

**Programming** R, Python, SQL, Matlab, VBA, C#

**Markup**  $\LaTeX$ , Markdown, RMarkdown

**Frameworks/Libraries** PyTorch, Tensorflow, numpy, pandas, dplyr, ggplot2

**Applications** Bash, Git, Docker

**Languages** English, Spanish (native)

## Certifications

### Computational Thinking using Python

MIT

June, 2020

EDX

Credential ID: d3560c0c0c2541b1a5a38ca2fd6ebd08

### Statistics with R

Duke University

Oct. 29, 2018

COURSERA

Credential ID: UWG3PS5EXMBJ

### Machine Learning

University of Washington

Feb. 1, 2017

COURSERA

Credential ID: 2VHFDHW5GUK6

### Data Science

Johns Hopkins University

Apr. 20, 2016

COURSERA

Credential ID: W9DB45S3CGDZ

## Publications

### Patents

Newton-based extremum-seeking control system

Timothy I Salsbury, Kirk H Drees, John M House, Carlos F. Alcala Perez

US Patent 10,824,127, 2020

System and method for output compensation in flow sensors using pulse width modulation

Carlos F. Alcala Perez, Kirk H Drees, Timothy I Salsbury

*US Patent 10,558,227, 2020*

Control system with dimension reduction for multivariable optimization

Timothy I Salsbury, Carlos F. Alcala Perez, John M House

*US Patent 10,558,177, 2020*

Building management system with voting-based fault detection and diagnostics

Carlos F. Alcala Perez

*US Patent 10,747,187, 2020*

Thermostat with efficient wireless data transmission

Timothy I Salsbury, Carlos F. Alcala Perez, Homero L Noboa

*US Patent 10,739,028, 2020*

Building management system with predictive diagnostics

Samuel F Hamilton, Carlos F. Alcala Perez

*US Patent 10,700,942, 2020*

Control system with asynchronous wireless data transmission

Carlos F. Alcala Perez, Kirk H. Drees

*US Patent 10,333,810, 2019*

Control system with response time estimation and automatic operating parameter adjustment

Carlos F. Alcala Perez, Timothy I. Salsbury

*US Patent 10324424, 2019*

Control system with response time estimation

Carlos F. Alcala Perez, Timothy I. Salsbury

*US Patent 10317856, 2019*

Building climate control system with decoupler for independent control of interacting feedback loops

Timothy I. Salsbury, Carlos F. Alcala Perez, John M. House, Christopher R. Amundson

*US Patent 10253997, 2019*

Building control system with decoupler for independent control of interacting feedback loops

Timothy I Salsbury, Carlos F Alcala Perez, John M House, Christopher R Amundson

*US Patent 10,253,997, 2019*

Feedback control system with normalized performance indices for setpoint alarming

Timothy I. Salsbury, Carlos F. Alcala Perez, Michael J. Ajax

*US Patent 10,197,977, 2019*

Systems and methods for steady state detection

Carlos F. Alcala Perez

*US Patent 10,495,334, 2019*

Normalized indices for feedback control loops

Timothy I. Salsbury, Carlos F. Alcala Perez

*US Patent 9920943, 2018*

Systems and methods for adaptive sampling rate adjustment

Carlos F. Alcala Perez, Timothy I. Salsbury

*US Patent 9395708, 2016*

## **Journal Papers**

Self-perturbing extremum-seeking controller with adaptive gain

Timothy I. Salsbury, John M. House, Carlos F. Alcala

*Control Engineering Practice 101 (2020) p. 104456. 2020*

A method for setpoint alarming using a normalized index

Carlos F. Alcala, Timothy I. Salsbury

*Control Engineering Practice 60.3 (2017) pp. 1–6. 2017*

An extremum-seeking control method driven by input–output correlation

Timothy I Salsbury, John M House, Carlos F Alcala, Yaoyu Li

*Journal of Process Control 58 (2017) pp. 106–116. Elsevier, 2017*

Analysis and generalization of fault diagnosis methods for process monitoring

Carlos F. Alcalá, S. Joe Qin

*Journal of Process Control* 21.3 (2011) pp. 322–330. 2011

## Generalized reconstruction-based contributions for output-relevant fault diagnosis with application to the tennessee eastman process

Gang Li, Carlos F. Alcalá, S. Joe Qin, Donghua Zhou

*Control Systems Technology, IEEE Transactions on* 19.5 (Sept. 2011) pp. 1114–1127. 2011

## Reconstruction-based contribution for process monitoring with kernel principal component analysis

Carlos F. Alcalá, S. Joe Qin

*Industrial & Engineering Chemistry Research* 49.17 (2010) pp. 7849–7857. 2010

## Reconstruction-based contribution for process monitoring

Carlos F. Alcalá, S. Joe Qin

*Automatica* 45.7 (2009) pp. 1593–1600. 2009

## Conference Papers

### Self-optimizing Control of an Air Source Heat Pump

Zhongfan Zhao, Yaoyu Li, Timothy I Salsbury, Carlos F Alcalá, John M House

*2019 American Control Conference (ACC)*, 2019

### Identification of a Self-Optimizing Control Structure from Normal Operating Data

Carlos F Alcalá, Timothy I Salsbury, John M House

*2019 American Control Conference (ACC)*, 2019

### Decoupling Method for PI Controllers via Setpoint Modification Applied to HVAC Systems

Timothy I Salsbury, John M House, Carlos F Alcalá

*ASME 2018 Dynamic Systems and Control Conference*, 2018

### Reduction of Transmissions in Wireless Thermostats with Send-on-Delta Sampling and a Deadband Filter

Carlos F Alcalá, Timothy I Salsbury

*2018 Annual American Control Conference (ACC)*, 2018

### Decoupling Method for PI Controllers via Setpoint Modification Applied to HVAC Systems

Timothy I. Salsbury, John M. House, Carlos F. Alcalá

*Proceedings of the Dynamic Systems and Control Conference*, 2018

### Reduction of Transmissions in Wireless Thermostats with Send-on-Delta Sampling and a Deadband Filter

Carlos F. Alcalá, Timothy I. Salsbury

*Proceedings of the 2018 Annual American Control Conference (ACC)*, 2018

### Model Selection for Predicting the Return Time from Night Setback

John E Seem, John M House, Carlos F Alcalá

*Proceedings of the International High Performance Buildings Conference*, 2016

### Two new normalized EWMA-based indices for control loop performance assessment

Timothy I. Salsbury, Carlos F. Alcalá

*Proceedings of the American Control Conference (ACC)*, 2015

### Monitoring of dynamic processes with subspace identification and principal component analysis

Carlos F. Alcalá, Ricardo Dunia, S. Joe Qin

*Proceedings of the 8th IFAC International Symposium on Fault Detection, Supervision and Safety of Technical Processes*, 2012, Mexico City, Mexico

### Unified analysis of diagnosis methods for process monitoring

Carlos F. Alcalá, S. Joe Qin

*Proceedings of the 7th IFAC International Symposium on Fault Detection, Supervision and Safety of Technical Processes*, 2009, Barcelona, Spain

### Unification of contribution analysis for process monitoring

Carlos F. Alcalá, S. Joe Qin

*Proceedings of the 2008 AIChE Annual Meeting*, 2008, Philadelphia, USA

### Reconstruction-based contribution for process monitoring

Carlos Alcalá, S. Joe Qin

*Proceedings of the 17th IFAC World Congress*, 2008, Seoul, Korea