

# Carlos Felipe **Alcala Perez**

Milwaukee, WI. | ☎ (+1) 414-426-6814 | ✉ alcala21@gmail.com | 📱 alcala21 | 🌐 alcala21 | 🏠 Carlos F. Alcala

## Data Scientist

### Summary

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Accomplished Data Scientist with extensive experience in the gathering, cleaning, modeling, analysis and visualization of large amounts of data to solve problems in the Building Efficiency industry. Highly skilled in using advanced tools to develop and implement data science methods and achieve business goals. Award winning scholar who holds multiple patents.

### Expertise

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- Multivariate Statistical Analysis
- Machine Learning
- Mathematical Analysis
- Data Analytics and Visualization
- Application Development
- Research and Development

### Experience

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#### Johnson Controls

PRINCIPAL RESEARCH ENGINEER

Milwaukee, WI

Oct. 2011 - Jan. 2020

Dec. 2017 - Jan. 2018

- 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

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### 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

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**Programming** R, Python, Matlab, VBA, RMarkdown,  $\LaTeX$   
**Applications** Sublime Text, Git, Github, Visual Studio Code  
**Languages** English, Spanish (native)

## Certifications

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### 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

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### Patents

Newton-based extremum-seeking control system

Timothy I Salisbury, 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 Salisbury

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. Alcala, 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

C. F. Alcalá, T. 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

Ricardo Dunia Carlos F. Alcalá, 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