

# Carlos Felipe Alcala Perez

Data Scientist

## contact

Milwaukee, Wisconsin  
53207, USA

+1 (414) 426 6814

alcala21@gmail.com  
LinkedIn://alcala21  
GitHub://alcala21

## languages

spanish (native)  
english (fluent)

## programming

R, Python, Matlab,  
Modelica, L<sup>A</sup>T<sub>E</sub>X,  
RMarkdown, Bash

## applications

Simulink, Dymola,  
RStudio, Git, Github,  
Visual Studio Code

## certifications

Statistics with R  
Machine Learning  
Data Science

## education

2007–2011 **Doctor of Philosophy** in Chemical Engineering  
University of Southern California. Los Angeles, California.

2005–2007 **Master of Science** in Chemical Engineering  
The University of Texas at Austin. Austin, Texas.

1999–2004 **Bachelor of Science** in Chemical Engineering  
Technological Institute of Ciudad Madero. Ciudad Madero, Mexico  
Summa Cum Laude.

## research interests

Data Analytics, Statistical Analysis, Machine Learning, Tuning and Monitoring of PID Controllers, Fault Detection and Diagnosis, Optimization, Self-Optimizing Control, Extremum-Seeking Control

## experience

### full time

2017 – 2020 **Johnson Controls International** Milwaukee, Wisconsin.  
*Principal Research Engineer.*

- I worked in the development and implementation of methods to improve the efficiency of heating, ventilation and air conditioning (HVAC) systems. I make use of traditional and modern optimization methods, as well as artificial intelligence and machine learning methods. I'm also involved in the transfer of newly developed technology into products and applications.

2015 – 2017 **Johnson Controls International** Milwaukee, Wisconsin.  
*Senior Research Engineer*

- I 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. I used advanced mathematical tools to develop these methods, as well as artificial intelligence, machine learning and traditional statistical methods.

2013 – 2015 **Johnson Controls BE Servicios** Mexico City, Mexico.  
*Senior Research Engineer*

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

2011 – 2013 **Johnson Controls, Inc** Milwaukee, Wisconsin.  
*Senior Research Engineer*

- I developed a method for adaptive sampling of PID controllers.

## internships

- 2010      **The Dow Chemical Company**      Freeport, Texas  
*Summer Research Intern*  
I developed an Excel application for multivariate statistical monitoring of continuous and batch processes.
- 2009      **Capstone Technology**      Seattle, Washington  
2007      *Summer Engineering Intern*  
2006
  - Developed a multivariate image analysis application to monitor combustion efficiency in furnaces.
  - Developed a multivariate statistical application for statistical modeling and prediction in chemical processes.
  - Developed a multivariate statistical application for detection and diagnosis of sensor and process faults.
- 2008      **NMC North Microelectronics**      Beijing, China  
*Summer Engineering Intern*  
  - I developed a multivariate statistical application for monitoring the operation of a semiconductor manufacturing process.

## awards

- 2015      **1st Place - 2015 BE TechChallenge**      Building Efficiency, Johnson Controls Inc.  
I won the annual company-wide innovation competition at JCI.
- 2007      **Roberto Rocca Fellowship**      University of Southern California  
I was awarded a fellowship from the Roberto Rocca Education Program to do my PhD at USC.
- 2005      **Fulbright Scholarship**      University of Texas at Austin  
I was awarded a Fulbright scholarship to do my Masters degree at UT Austin.

## publications

### Patents

- 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 asynchronous wireless data transmission  
Carlos F. Alcala Perez, Kirk H. Drees  
*US Patent 10333810, 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 management system with voting-based fault detection and diagnostics  
Carlos F. Alcala Perez  
*US Patent 10401262, 2019*

### **Control system with response time estimation**

Carlos F. Alcala Perez, Timothy I. Salsbury

*US Patent 10317856, 2019*

### **Feedback control system with normalized performance indices for setpoint alarming**

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

*US Patent 10197977, 2019*

### **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 App. 15/908,041, 2018*

### **System and method for output compensation in flow sensors**

Carlos F. Alcala Perez, Kirk H Drees

*US Patent App. 15/897,987, 2018*

### **Normalized indices for feedback control loops**

Timothy I. Salsbury, Carlos F. Alcala Perez

*US Patent 9920943, 2018*

### **Thermostat with efficient wireless data transmission**

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

*US Patent App. 15/618,492, 2017*

### **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 App. 16/253,965, 2017*

### **Systems and methods for steady state detection**

Carlos F. Alcala Perez

*US Patent App. 15/449,732, 2017*

### **Systems and methods for automatically creating and using adaptive pca models to control building equipment**

Carlos F. Alcala Perez

*US Patent App. 15/279,336, 2016*

### **Systems and methods for adaptive sampling rate adjustment**

Carlos F. Alcala Perez, Timothy I. Salsbury

*US Patent 9395708, 2016*

### **Building management system with predictive diagnostics**

Carlos F. Alcala Perez, Samuel F. Hamilton

*US Patent App. 15/188,824, 2016*

## **Journal Papers**

### **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. Alcala, 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. Alcala, S. Joe Qin

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

**Reconstruction-based contribution for process monitoring**

Carlos F. Alcala, 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 Alcala, John M House

*2019 American Control Conference (ACC)*, 2019

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

Carlos F Alcala, 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 Alcala

*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 Alcala, 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. Alcala

*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. Alcala, 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 Alcala

*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. Alcala

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

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

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

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

**Reconstruction-based contribution for process monitoring**

Carlos Alcala, S. Joe Qin

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