

# John C. Kegelman

ALGORITHMS AND VEHICLE DYNAMICS LEAD AT PELOTON TECHNOLOGY

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## Education

### Stanford University

PH.D. IN MECHANICAL ENGINEERING

Stanford, CA

Apr. 2012–Dec. 2018

- Thesis topic: Learning from Highly-Skilled Drivers to make Automated Vehicles Safer

### Stanford University

M.S. IN MECHANICAL ENGINEERING

Stanford, CA

Sep. 2009–Apr. 2012

- Coursework focused on controls, advanced dynamics and simulation, and electromechanical design.

### Johns Hopkins University

B.S. IN MECHANICAL ENGINEERING

Baltimore, MD

Sep. 2005–May 2009

- 4.0 GPA. Minored in Entrepreneurship and Management.

## Research Interests

I investigate how we can learn from highly-skilled race car drivers to make automated vehicles safer. I explore how human control techniques at the limits of handling can be adapted into algorithms for autonomous vehicles. I can contribute a deep understanding of vehicle dynamics and controls with practical experience and a great appreciation that all models are wrong, but some are useful.

## Experience

### Peloton Technology

ALGORITHMS AND VEHICLE DYNAMICS LEAD

Mountain View, CA

Aug. 2019–PRESENT

- Led team of four vehicle software engineers developing control, estimation, and perception algorithms.
- Helped establish a BigTable database to facilitate access to and analysis of logged vehicle data using C++ and Python tools.
- Built and released three major, three minor, and seventeen patch versions of Peloton's vehicle software.
- Developed architecture for integrating with automotive radar sensors from two different manufacturers.

### Peloton Technology

SENIOR SOFTWARE ENGINEER

Mountain View, CA

May 2017–Aug. 2019

- Developed safety-critical, production software in a continuous integration and testing environment.
- Implemented a distributed safety monitoring system in C++ for a commercial platooning system following the ISO 26262 standard.
- Collected, compiled, and analyzed braking data to inform the safety of the intended functionality (SOTIF) analysis of a commercial platooning system.
- Developed a graphical user interface in Python using Matplotlib and pandas for vehicle data visualization and exploratory data analysis.
- Contributed to Peloton's estimation, modeling, and control modules, including comprehensive simulation, software-in-the-loop, and hardware-in-the-loop testing environments.
- Incorporated automatic Python linting (pylint) and formatting (YAPF) into Peloton's build and test infrastructure (Bazel run by Buildbot).

### Dynamic Design Lab

GRADUATE RESEARCH ASSISTANT, PI: PROF. J. CHRISTIAN GERDES

Stanford, CA

Sep. 2009–Dec. 2018

- Collected, compiled, analyzed, and openly published vehicle dynamics data from highly-skilled professional race car drivers during live racing events to gain insights into vehicle control at the limits of handling.
- Compared human performance with autonomous vehicles to improve operating capabilities of active vehicle safety systems.
- Implemented autonomous vehicle control using drive-by-wire hardware and convex optimization software to operate at the handling limits while following a desired trajectory.
- Implemented and tested control algorithms on experimental vehicles using C and MATLAB.
- Pioneered a comprehensive, noninvasive vehicle instrumentation suite for vintage race cars with significant historical value.
- Developed a graphical user interface in MATLAB for vehicle data visualization and exploratory data analysis.
- Assembled and maintained an end-to-end solution from surveyed GNSS base stations to on-board integrated navigation systems enabling research vehicles to operate reliably with centimeter-level position measurement accuracy.
- Installed and operated a Linux-based NTRIP caster to broadcast Differential GNSS corrections from multiple servers to multiple clients.

## Stanford Department of Mechanical Engineering

Stanford, CA

SENIOR TEACHING ASSISTANT — MECHANICAL SYSTEMS DESIGN, PROFS. MARK CUTKOSKY AND PAUL MITIGUY

Jan.–Mar. 2016

- Developed curriculum and coordinated team of five other teaching assistants.
- Led hands-on laboratory and tutorial sessions for course with 150 undergraduates exploring characteristics of machine elements.
- Advised design-project teams emphasizing the balance of physical and virtual prototyping based on engineering analysis.

TEACHING ASSISTANT — MECHANICAL SYSTEMS DESIGN, PROF. J. CHRISTIAN GERDES

Jan.–Mar. 2012

- Aided hands-on laboratory and tutorial sessions for course with 150 undergraduates exploring characteristics of machine elements.
- Advised design-project teams emphasizing the balance of physical and virtual prototyping based on engineering analysis.

## Johns Hopkins Department of Mechanical Engineering

Baltimore, MD

TEACHING ASSISTANT — MECHANICAL ENGINEERING FRESHMAN LABORATORY, PROF. ALLISON OKAMURA

Sep.–Dec. 2008

- Helped plan, organize, and conduct weekly hands-on laboratory sessions.
- Provided assistance during weekly laboratory sessions for approximately 20 students per session exploring basic physical science and engineering principles pertaining to mechanical engineering.

UNDERGRADUATE RESEARCH ASSISTANT, PI: PROFS. CHARLES MENEVEAU AND JOSEPH KATZ

Jan.–May 2007

- Designed and documented new test section, including a fractal canopy, for the project titled *Measuring and Modeling Interactions of the Turbulent Atmospheric Boundary Layer with Multiscale Ground Topology* to be conducted in the laboratory's axial turbomachinery water tunnel.

## Johns Hopkins University Applied Physics Laboratory

Laurel, MD

BIOMEDICINE GROUP INTERN, PI: DR. JAMES BEATY

May–Aug. 2008

- Developed method for capturing primate hand motion using Vicon cameras for the Revolutionizing Prosthetics Program.
- Designed and installed two on-site camera systems, prepared internal manual documentation, and trained multiple staff members to use the system proficiently.

## NASA Langley Research Center

Hampton, VA

LANGLEY AEROSPACE RESEARCH SUMMER SCHOLAR, PI: STEVEN BAUER

Jun.–Aug. 2007

- Collected and compiled experimental data from wind tunnel testing of the separation event of Ares I-X, the experimental flight test vehicle for NASA's next crew launch vehicle.
- Collected, compiled, and analyzed computational data using NASA-developed computational fluid dynamics (CFD) software for the descent database of the Upper Stage Simulator.

## New Horizons Governor's School for Science and Technology

Hampton, VA

CHIEF INVESTIGATOR, PI: DICK DELOACH

Sep. 2004–May 2005

- Research and mentorship program with NASA Langley Research Center.
- Investigated various swimming techniques by applying the Modern Design of Experiments to the biomechanics of swimming.

## Publications

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### JOURNAL ARTICLES

Neural network vehicle models for high-performance automated driving

Nathan A. Spielberg, Matthew Brown, Nitin R. Kapania, John C. Kegelman, J. Christian Gerdes

*Science Robotics* 4.28 (2019). Science Robotics

Vehicle control synthesis using phase portraits of planar dynamics

Carrie G. Bobier-Tiu, Craig E. Beal, John C. Kegelman, Rami Y. Hindiyeh, J. Christian Gerdes

*Vehicle System Dynamics* 57.9 (2019) pp. 1318–1337. Taylor & Francis

Insights into vehicle trajectories at the handling limits: analysing open data from race car drivers

John C. Kegelman, Lene K. Harbott, J. Christian Gerdes

*Vehicle System Dynamics* 55.2 (2017) pp. 191–207. Taylor & Francis

### THESIS

Learning from professional race car drivers to make automated vehicles safer

John C. Kegelman

Stanford University, PhD, 2018

### CONFERENCE PROCEEDINGS

Analysis of Measured Racing Lines : A Path Primitive Based Curve Fitting Approach

Guido Koch, John C. Kegelmann, J. Christian Gerdes  
*The 11th International Symposium on Advanced Vehicle Control, 2012*

Repeatability of arm pull patterns in front crawl swimming  
Lester K. Su, John C. Kegelmann  
*American Physical Society, 62nd Annual Meeting of the APS Division of Fluid Dynamics, 2009*

## PATENTS

Distributed Safety Monitors for Automated Vehicles  
Todd C. Klaus, Colleen K. Twitty, Stephen M. Erlien, John C. Kegelmann, Charles A. Price, Austin B. Schuh, Joshua P. Switkes  
Peloton Technology Inc, US 10234871B2, Jan. 14, 2019

## Honors & Awards

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2009–2012 Stanford Graduate Fellowship in Science and Engineering  
2009 NCAA Postgraduate Scholarship  
2009 ESPN The Magazine Academic All-American of the Year  
2008 Barry M. Goldwater Scholarship  
2008 Johns Hopkins University Provost's Undergraduate Research Award  
2008 Robert George Gerstmyer Award, Johns Hopkins Department of Mechanical Engineering  
2007–2009 Hodson Trust Scholarship  
2005–2007 Michael Bloomberg Scholarship  
2007 American Society of Heating, Refrigeration and Air Conditioning Engineers Scholarship, Baltimore Chapter  
2006, 2008 Honorable Mention All-American, NCAA Division III Swimming  
2005 Balanced Man Scholarship, Sigma Phi Epsilon, Johns Hopkins Chapter  
2005 Armed Forces Communication and Electronics Association Scholarship, Tidewater Chapter

## Extracurricular Activity

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2012–2014	Club Cycling Team	<i>Stanford University</i>
2009–2013	<b>President</b> , 2010–2012, Club Triathlon Team	<i>Stanford University</i>
2005–2009	<b>Captain</b> , 2007–2009, Varsity Men's Swim Team	<i>Johns Hopkins University</i>
2007	<b>President</b> , 2008–2009, Pi Tau Sigma, Mechanical Engineering Honor Society	<i>Tau Alpha Chapter</i>
2007	Tau Beta Pi, Engineering Honor Society	<i>Maryland Alpha Chapter</i>

## Personal

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- Born May 6, 1987, St. Louis, Missouri, USA.