

# Jason Zhenhao Zhou

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## Personal Profile

I'm a Ph.D. candidate double-major in Mechanical Engineering and Computer Science at the University of Wisconsin Madison. My research focuses on the development and validation of digital twins and their applications in control designs of robotic systems and autonomous vehicles. My research experiences allow me to develop strong programming capabilities, knowledge in high-performance computing, deep understandings in multi-body dynamics and physics simulation, and computer graphics.

## Education

### University of Wisconsin-Madison

Doctor of Philosophy in Mechanical Engineering

Madison, WI

Jan 2021 - May 2025

### University of Wisconsin-Madison

Master of Science in Mechanical Engineering

Madison, WI

Jan 2021 - May 2023

### University of Wisconsin-Madison

Master of Science in Computer Science

Madison, WI

Jan 2021 - Dec 2022

- GPA: 3.9.
- Graduated on Dec. 18, 2022.
- **Courses:** Data Science, Machine Learning, Wireless Communication, Computer Networks, Distributed Computing, Computer Architectures.

### University of Wisconsin-Madison

Bachelor of Science in Mechanical Engineering

Madison, WI

Sep 2017 - Dec 2020

- GPA: 3.8.
- Graduated on Dec. 13, 2020.
- **Courses:** Robotic Systems, Manufacturing Automation, Design Optimization, Thermal Dynamics, Fluid Dynamics, Static and Dynamic Systems

### University of Wisconsin-Madison

Bachelor of Science in Computer Science

Madison, WI

Sep 2017 - Dec 2020

- GPA: 3.8.
- Graduated on Dec. 13, 2020.
- **Courses:** Machine Learning, Computer Vision, Computer Graphics, Operating System, Optimization Theory, Database

## Work Experience

### Simulation-Based Engineering Lab at UW-Madison

Graduate Research Assistant

Madison, WI

Jan 2021 - Present

- Advisor: Professor Dan Negrut.
- Autonomous vehicle coordination and simulation of vehicle dynamics, leveraging simulation fidelity and real-time performance for Human-In-The-Loop(HIL) and Software-In-The-Loop(SIL) applications. Head developer of chrono::HIL, a submodule of Project Chrono (<https://projectchrono.org/>) to provide HIL, real-time simulation support for traffic scenarios and vehicle dynamics. chrono:HIL provides flexible simulator hardware coupling capabilities, distributed simulation support, soft real-time simulation support, and multiple vehicle dynamic models. Integrating sensor (lidar/radar/camera sensor) simulation using chrono::sensor into traffic scenarios to assist the development of autonomous vehicle control policies. Providing simulation support for human-factor research conducted by Cognitive Systems Laboratory at UW-Madison. Funded by National Science Foundation OAC2209791.
- Extraterrestrial rover and robot mechanical component simulation. Applications/development/validation of SCM (Soil Contact Model), SPH, and DEM deformable terrain. Developer of the VIPER lunar rover model and the Curiosity mars rover model in the chrono::robot module. Integrating sensor simulation support to provide Lidar/Radar perception data in harsh lunar environment. Funded by NASA to support 2023 VIPER lunar mission.

### Simulation-Based Engineering Lab at UW-Madison

Undergraduate Research Assistant

Madison, WI

Jun 2020 - Dec 2020

- Advisor: Professor Dan Negrut.
- Development and validation of chrono::granular (later renamed as chrono::gpu), a CUDA solver for granular dynamics. chrono::granular can be used to simulate homogeneous granular material; applications include granular material properties testing and deformable terrain for off-road vehicle research.
- Development of synchronization functionalities in chrono::synchrono - MPI and DDS interfaces of chrono::vehicles; utilization of parallel computing for real-time performance.

## Human Computer Interaction Lab at UW-Madison

Madison, WI

Undergraduate Research Assistant

Sep 2019 - May 2020

- Advisor: Professor Bilge Mutlu.
- Developing a QR Marker object tracking program based on OpenCV in C++. The program helps educational robots to identify objects and their movements in order to facilitate human-computer interaction.
- Designing and developing of simulation environment for robot localization algorithm using ROS2. The simulation environment allows a Turtlebot model to follow certain trajectories in an indoor environment relying purely on QR codes identified by the machine learning algorithm.
- Creating of the CAD models for robot's parts using Solidworks and 3D printing software.

## Alstom

Melbourne, FL

Software Engineering Intern & Embedded System Engineering Intern

May 2019 - Aug 2019

- Cooperating with Alstom's System Validation Team to perform system tests and review code (primarily in C++ and Python) on Alstom DAU (Data Acquisition Unit), a vital wayside component of the Alstom's Automatic Railway Signaling System; Debugging lower-level program, scanning and hacking the Apache server installed to search for possible bugs which may lead to the fatal crash of the system.
- Developing a C++ testing program for Alstom's Wayside Linux-Based Core ACE board to meet Hardware Serial Test Specifications including multi-CPU communication, I2C, UART, SPI, onboard GPIO connection, Watchdog Timer, and other hardware checks. The testing program includes both lower-level hardware programming and higher-level algorithm programming.

## Projects

### Mechanical Engineering Senior Design Project

Madison, WI; Milwaukee, WI

Milwaukee Tool

Sep 2019 - May 2020

- Designing a glove impact testing fixture to quantitatively measure the impact protection provided by impact-resistant gloves.
- Completing three iterations of CAD model design and FEA analysis, and creating engineering drawings for Milwaukee Tool's workshop to manufacture parts
- Working with resistance-based force sensor circuits and related component.
- Designing and creating ready-to-deliver LabView programs to integrate pneumatic system and data acquisition unit (NI C-DAQ)

### Solidworks Training Design Project

Madison, WI

University of Wisconsin-Madison

Nov 2018

- Designing a drone frame and a drone cover which meets the requirements provided with limited ABS Material using Solidworks and PareToWorks
- Performing FEA structural analysis in Solidworks to ensure the design meets performance and endurance requirement.

## Skills

<b>Programming</b>	Python, C/C++/C#, CUDA, HTML/CSS, Java, JavaScript, Julia, R, SQL.
<b>Engineering/Design</b>	Solidworks, Blender, MSC Adams, ROS, Unity, Unreal Engine, Matlab, Simulink, Rhino, COMSOL Multiphysics
<b>Miscellaneous</b>	Linux, Shell, Latex, Firebase Interface, Windows CMD, Tensor, Unity, Unreal Engine, Tensorflow, OpenCV, Keras

## Publication

- Serban, R, Taves, J, **Zhou, Z**. "Real-Time Simulation of Ground Vehicles on Deformable Terrain." *Proceedings of the ASME 2022 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. Volume 9: 18th International Conference on Multibody Systems, Nonlinear Dynamics, and Control (MSNDC)*. St. Louis, Missouri, USA. August 14–17, 2022. V009T09A012. ASME. <https://doi.org/10.1115/DETC2022-89470>
- Hu, W., **Zhou, Z**., Chandler, S., Apostolopoulos, D., Kamrin, K., Serban, R., Negrut, D. Traction control design for off-road mobility using an SPH-DAE cosimulation framework. *Multibody Syst Dyn* 55, 165–188 (2022). <https://doi.org/10.1007/s11044-022-09815-2>
- Hu, W., **Zhou, Z**., Serban, R., Negrut, D., Using an SPH-based continuum representation of granular terrain to simulate VIPER rover mobility, 2021/10, *Preprint*, [https://www.researchgate.net/publication/358872957\\_Off-Road\\_Rover\\_Mobility\\_Simulation\\_Using\\_a\\_Continuum\\_Representation\\_of\\_Deformable\\_Terrains](https://www.researchgate.net/publication/358872957_Off-Road_Rover_Mobility_Simulation_Using_a_Continuum_Representation_of_Deformable_Terrains)
- Hu, W, **Zhou, Z**, Serban, R, Negrut, D. "Using an SPH-Based Continuum Representation of Granular Terrain to Simulate the Rover Mobility." *Proceedings of the ASME 2021 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. Volume 9: 17th International Conference on Multibody Systems, Nonlinear Dynamics, and Control (MSNDC)*. Virtual, Online. August 17–19, 2021. V009T09A028. ASME. <https://doi.org/10.1115/DETC2021-71289>

## Videos

- Curiosity Obstacle Crossing on SCM Deformable Terrain with Simulated Lidar and Radar Sensing [https://www.youtube.com/watch?v=fkDvNyLQCqM&t=40s&ab\\_channel=UWSBEL](https://www.youtube.com/watch?v=fkDvNyLQCqM&t=40s&ab_channel=UWSBEL)
- Chrono::FSI - Mobility Simulation of Moon Viper on Side-Tilted Granular Material Terrain [https://www.youtube.com/watch?v=UbrKRxrc9co&ab\\_channel=UWSBEL](https://www.youtube.com/watch?v=UbrKRxrc9co&ab_channel=UWSBEL)
- SynChrono Iowa Highway Autonomous Vehicle Testing with Human in the Loop [https://www.youtube.com/watch?v=DIyI1YxQxbo&t=3s&ab\\_channel=UWSBEL](https://www.youtube.com/watch?v=DIyI1YxQxbo&t=3s&ab_channel=UWSBEL)
- Using Human-In-The-Loop and Software-In-The-Loop Simulation to Facilitate Traffic Ring Experiment [https://www.youtube.com/watch?v=uu--DRFKVD4&t=61s&ab\\_channel=UWSBEL](https://www.youtube.com/watch?v=uu--DRFKVD4&t=61s&ab_channel=UWSBEL)