

GANESH ARIVOLI

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SUMMARY

Graduate student in Mechanical Engineering focused on developing GPU-accelerated physics engines for robotics and autonomous systems. Experienced in building high-fidelity simulation frameworks for accurate and fast simulation of complex systems. Skilled in C++, CUDA, and Python (Warp, Taichi) with foundations in multibody dynamics, numerical methods, and high-performance computing. Active contributor to [Project Chrono](#), developing GPU-based FEA and linear solver frameworks for large-scale flexible multibody dynamics with frictional contact.

EDUCATION

University of Wisconsin-Madison <i>Master of Science, Mechanical Engineering, Advisor: Dan Negrut</i>	Dec 2026 (Expected) Current GPA: 4.0/4.0
National Institute of Technology, Tiruchirappalli <i>Bachelor of Technology, Mechanical Engineering</i>	May 2021 (Completed)

RELEVANT COURSEWORK

High Performance Computing, Advanced Computational Dynamics, Kinematics, Dynamics and Control of Robotic Manipulators, Feedback Control, Mechanics of Machines, Mechatronics, Vehicle Dynamics, Machine Learning, Linear Optimization, Computer Vision

RESEARCH EXPERIENCE

Robotics Intern - Dynamics and Simulation | *Toyota Research Institute, CA* May 2026 – Present

- Conducting a comprehensive characterization of hydroelastic contact representations (tetrahedral mesh, SDF-based, etc.) across contact surface accuracy, geometric generality, robustness, and computational performance.
- Studied the effect of contact reduction and solver formulation on hydroelastic contact fidelity and efficiency.
- Developing hydroelastic contact and solver modules for [NVIDIA Newton](#)'s GPU-resident physics pipeline.

GPU-Based Total-Lagrangian FEA Framework for Multibody Dynamics | *UW-Madison* May 2025 – May 2026

- Developed a GPU-optimized unified Total Lagrangian FEA formulation for flexible multibody dynamics with large deformations, kinematic constraints, hyperelastic and viscoelastic materials, and frictional contact.
- Implemented and optimized a GPU-resident nonlinear solve pipeline with implicit (second-order Newton, first-order AdamW) and explicit (leapfrog) solvers, utilizing BVH-free collision detection.
- Validated against closed-form analytical solutions and achieved a **10× speedup** over CPU baselines at up to 1.7M DOFs.
- Contributed to [open-source implementation](#) and two papers ([Part I](#), [Part II](#)) currently under review.

GPU-Based Linear Solvers for Multibody Dynamics | *UW-Madison* Dec 2024 – May 2025

- Investigated scaling of GPU-based sparse direct solver phases (symbolic analysis, factorization, and solve) with problem size, evaluating solve time and solution accuracy for multibody dynamics applications.
- Observed a **3.6× speedup** with CuDSS over Pardiso on large ANCF systems, within engineering accuracy tolerances.
- Results summarized in a [published extended abstract](#) at ASME IDETC-CIE 2025 with [reproducible code](#).

Autonomous Terrain Leveling | *UW-Madison* Jan 2025 – May 2025

- Built a CNN-based differentiable surrogate of bulldozer-soil interaction trained on Chrono::FSI physics-based simulation data, enabling gradient-based blade control optimization for autonomous terrain leveling.
- Developed training and inference pipelines on HPC clusters to support large-scale data generation and model deployment.
- Achieved a **48% improvement** in terrain-leveling performance; published in *Advanced Robotics Research* (DOI).

DEM Simulation for Komatsu Loader | *Komatsu Mining Corp, Longview, TX* Jan 2025 – June 2025

- Developed a multibody dynamics model of a Komatsu loader and integrated it with a GPU-accelerated [DEM engine](#), enabling high-fidelity simulation of loader-granular material interaction.
- Conducted simulation-driven parametric analysis of bucket geometry and motion to optimize excavation efficiency.

SELECTED PROJECTS

Physics Engine for Rigid/Flexible Multibody and Robotic Systems | *UW-Madison*

Aug 2025 – Dec 2025

- Developed a high-fidelity multibody dynamics simulator for rigid and flexible systems using generalized coordinates, constraints, BDF time-stepping, and a custom Newton-Raphson solver.
- Extended the engine to support multi-DOF serial robotic manipulators with kinematics, dynamics, control, trajectory generation, and real-time visualization.

GPU Accelerated Path Planning for Autonomous Robots | *UW-Madison*

Jan 2025 – Apr 2025

- Implemented parallelized RRT and RRT* algorithms in CUDA (GPU) and OpenMP (multicore CPU), optimizing collision checking and nearest-neighbor routines for high-dimensional planning in obstacle-dense environments ([code](#)).
- Built a benchmarking suite with physics-based simulation to evaluate planning latency, control feasibility, and trajectory smoothness.

ADDITIONAL EXPERIENCE

Vehicle Dynamics Engineer (R&D) | *Bajaj Auto, India*

Sep 2021 – Dec 2023

- Led the design and development of suspension and steering systems for Bajaj Auto-Triumph motorcycles, integrating physics-based simulation models into the product development cycle and contributing to **100,000+** units sold across **58+** countries.
- Improved **ride and handling performance by 15%** through multibody dynamics simulations, optimizing suspension parameters.
- Key contributor to the [Triumph Speed 400](#) and [Scrambler 400 X](#), launched globally in 2023.

Graduate Teaching Assistant | *UW-Madison*

Jan 2026 – May 2026

- Supported CS 759, a graduate-level High-Performance Computing programming course covering CUDA, OpenMP, and MPI.
- Held office hours and graded assignments on debugging, performance analysis, and parallel programming projects.

SAE BAJA Racing Team | *NITT, India*

May 2018 – May 2021

- Led powertrain and data acquisition sub-teams in design, fabrication, and testing of an All-Terrain Vehicle for SAE BAJA India, an intercollegiate off-road engineering competition, securing **consecutive 5th place** finishes in 2020 and 2021 among **100+** teams.
- Built a MATLAB-based CVT model for simulation-driven calibration, improving drivetrain efficiency by **10%** and reducing tuning time by **40%**.

SKILLS

Programming: C/C++, CUDA, Python (Warp, Taichi), OpenMP, MATLAB

Tools & Platforms: Linux, Git, NVIDIA Nsight, Docker, ROS (basic), VSCode, Bazel

Simulation: Project Chrono, Drake, NVIDIA Newton, Mujoco, Simulink, MSC Adams

PUBLICATIONS

- **Ganesh Arivoli**, Huzaifa Unjhwala, Michael Taylor, Radu Serban, Dan Negrut, "On the Use of GPU-Based Linear Solvers in Multibody Dynamics," *Extended abstract presented at the ASME IDETC-CIE 2025*. <https://gnsh-a.github.io/assets/pdf/arivoliz025gpu.pdf>
- Zhenhao Zhou, **Ganesh Arivoli**, Dan Negrut, "A Total Lagrangian Finite Element Framework for Multibody Dynamics: Part I – Formulation," *under review at CMAME (2026)*. <https://arxiv.org/abs/2602.17002>
- Zhenhao Zhou*, Ruochun Zhang*, **Ganesh Arivoli**, Dan Negrut, "A Total Lagrangian Finite Element Framework for Multibody Dynamics: Part II – GPU Implementation," *under review at CMAME (2026)*. <https://arxiv.org/abs/2604.10357>
- Harry Zhang*, **Ganesh Arivoli***, Huzaifa Unjhwala, Luning Bakke, Radu Serban, Dan Negrut, "Data-Driven Bulldozer Blade Control for Autonomous Terrain Leveling," *Advanced Robotics Research (2026)*. <https://doi.org/10.1002/adrr.202500180>
- Huzaifa Unjhwala, Luning Bakke, Harry Zhang, Michael Taylor, **Ganesh Arivoli**, Radu Serban, Dan Negrut, "A Physics-Based Continuum Model for Versatile, Scalable, and Fast Terramechanics Simulation," *under review at Journal of Terramechanics (2025)*. <https://arxiv.org/abs/2507.05643>

* Equal contribution