Brian Day

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Professional Summary

My Ph.D. work has revolved around computational analysis and mathematical modelling of deformable systems to investigate their dynamics. I am experienced in constructing theoretical models and performing subsequent numerical analysis through simulating the nonlinear dynamics present in such systems. Beyond passive deformations dynamics, I have also explored optimization strategies for deformable systems whose internal controls allow for active deformations. Outside of data analysis, I am familiar with various modes of data visualization, which includes virtual reality (VR), to help facilitate understanding of abstract concepts and non-intuitive dynamics. I would love to continue expanding my computational skills through developing software to accelerate research. I meet the eligibility requirements for security clearance as a 28 year old U.S. citizen.

Skills

- 9+ years of experience with computational physics systems
- Comfortable supporting software users through generating documentation as well as in-person training and guidance
- Experienced in verification and validation of numerical simulation results
- Familiar with modeling and numerical analysis of physical systems
- Comfortable working with various programming languages (Python, C++/C#, Mathematica, JavaScript/HTML)
- Have experience developing and implementing optimization strategies

Research & Technical Experience

Graduate Research Assistant August 2017 - Present
Advisor: Dr. Elisabetta Matsumoto
Department of Physics, Georgia Institute of Technology

– Designing and developing computational physics engine for dynamical systems in spaces with intrinsic curvature
– Investigating and simulating the interplay between nonholonomic control systems and the geometry of their environment
– Designing and developing optimization algorithm to understand local and global notions of efficiency for deformable body dynamics
– Designing and developing educational, interactive 3D vector field visualization sandbox for static and dynamic fields in VR for undergraduate math and physics courses

VR Software Developer January 2023 - Present
International Institute for Sustainability with Knotted Chiral Meta Matter ($SKCM^2$), Hiroshima University

– Designing and developing source code for VR simulations visualizing knotted structures for research and outreach
– Collaborating with Director and Outreach Chair of $SKCM^2$ to prepare demonstrations for representatives from the World Premier International Research Center Initiative (WPI)
– Train and supervise group of professionals to use as well as guide future users through the simulations
– Assist with outreach activities at local Japanese high school

Graduate Researcher May 2021 - May 2022
Advisors: Dr. John Wise and Dr. Kwangho Park
Department of Physics, Georgia Institute of Technology

– Investigated 3D accretion hydrodynamics for black holes in hyperaccretion limit by translating dynamics from Enzo to Enzo-e (HPC hydrodynamics software for cosmological simulations)

Undergraduate Research Assistant May 2014 - May 2017
Advisor: Dr. Deirdre Shoemaker
Department of Physics, Georgia Institute of Technology

– Analyzed effectiveness of Bayeswave modeling to recover waveforms from gravitational wave signal data through PCA between model and real data
– Completed undergraduate thesis as a member of the Laser Interferometer Gravitational Wave Observatory (LIGO) Collaboration

Education

Ph.D. in Physics December 2023
Georgia Institute of Technology (GPA: 3.84/4.0)
Defended - November 29, 2023

M.S. in Physics July 2018
Georgia Institute of Technology (GPA: 3.5/4.0)

B.S. in Physics May 2017
Georgia Institute of Technology (GPA: 4.0/4.0)

Publications

Brian Day*, Steve Trettel, Elisabetta Matsumoto *Physics in Curved Space I: Internal Dynamics and Rigidity Constraints*, Manuscript in progress (2023)

Brian Day*, Steve Trettel, Elisabetta Matsumoto *Physics in Curved Space II: Nonholonomic Control Dynamics and Optimization*, Manuscript in progress (2023)

Brian Day*, Steve Trettel, Elisabetta Matsumoto *Mathematical Foundation of Optimization through sub-Riemannian Geometry in Geometric Mechanics Systems*, Manuscript in progress (2023)

Othman Alwari*, **Brian Day***, Elisabetta Matsumoto *Visualizing Virtual Vector Fields*, Published in Proceedings of Bridges 2022: Mathematics, Art, Music, Architecture, Culture (2022), http://archive.bridgesmathart.org/2022/bridges2022-367.html

Contributed Presentations

B. Day, S. Trettel, and E. A. Matsumoto, "Generalizing Deformable System Dynamics beyond Euclidean Geometry", APS March Meeting 2023, Las Vegas, Nevada, March 2023. (Talk)

O. Alwari, **B. Day**, and E. A. Matsumoto, "Visualizing Virtual Vector Fields", Bridges Conference 2022, Helsinki, Finland, August 2022. (Virtual Talk)

B. Day, S. Trettel, and E. A. Matsumoto, "Using Sub-Riemannian Geometry to Characterize Mechanics of Deformable Systems", APS March Meeting 2022, Chicago, Illinois, March 2022. (Virtual Talk)

O. Alwari, **B. Day**, and E. A. Matsumoto, "Realtime Vector Field Rendering in Unity Game Engine for STEM Education", APS March Meeting 2022, Chicago, Illinois, March 2022. (Talk)

B. Day, S. Trettel, and E. A. Matsumoto, "Swimming through Curved Space", APS March Meeting 2021, Atlanta, Georgia, March 2021. (Virtual Talk)

B. Day and E. A. Matsumoto, "Visualizing Fields and Space Using Virtual Reality", Illustrating Geometry and Topology, ICERM, Providence, Rhode Island, September 2019. (Poster)

B. Day and E. A. Matsumoto, "Visualizing Virtual Vector Fields", Georgia Institute of Technology Teaching Day, Atlanta GA, April 2018. (Poster)

B. Day, "Bayeswave Analysis Study on Recovering Waveform Complexity through Reconstructions", Georgia Institute of Technology Undergraduate Research Symposium, Atlanta GA, April 2017. (Poster)

Professional Activities

DSOFT Short Course: Computing Soft Matter Across Scales Attendee — Spring 2023
Morpho Software Workshop at Tufts University Attendee — Summer 2022
Enzo-E Developers + Users Workshop Attendee — Spring 2021
ICERM Illustrating Geometry and Topology Conference Attendee — Fall 2019, Spring 2020

Mentored Students

Othman Alrawi Georgia Institute of Technology, Atlanta, GA September 2021 - March 2022
- Supervised student in design and development of educational VR simulations.