John Morris

Mechanical and Systems Engineering
Clemson, SC

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Summary

As a researcher, my work into digital twins expands principles of model-based engineering to create universal frameworks for information systems, advancing modeling flexibility and representation. The applications of these multidisciplinary theories has led to collaborations in fields of manufacturing, defense, research, and software. This research in turn contributes to my role as PLM Applications Engineer at Clemson University, where I champion digital engineering initiatives by developing and teaching classes, 100+ seminars, and dozens of trainings on CAx and PLM.

Research Interests

Digital twins, digital and model-based engineering, system dynamics and optimization, and advanced modeling techniques for complex systems.

Education

PhD of Mechanical Engineering   December 2025

Clemson University; Clemson, SC
- Advisors: Dr. John Wagner, Dr. Gregory Mocko
- Dissertation: Universal Systems Simulation via Constraint Hypergraphs with Applications to Digital Twins

MS of Mechanical Engineering   August 2024

Clemson University; Clemson, SC
- Dual track emphasis: dynamics and controls, design and manufacturing

BS of Mechanical Engineering, Emphasis in Computer Science   April 2021

Brigham Young University; Provo, UT
- Founding leadership of Engineering Design Club
- 3x letterman in Men's Swimming (NCAA Div. I)

Publications

Journal Publications

1. John Morris, Gregory Mocko, and John Wagner. "Effects of Functional and Declarative Modeling Frameworks on System Simulation". *In Press with J. Dyn. Sys., Meas., Control (ASME)* (Jan. 2026).

2. Frederick Rowell, John Morris, Todd Schweisinger, and John Wagner. "Digital Engineering Education Challenges and Opportunities–A Case Study in a Mechanical Engineering Senior Capstone Design Course". *In press with Intl. J. of Product Lifecycle Management* (Oct. 2025).

3. John Morris, Gregory Mocko, and John Wagner. "Unified System Modeling and Simulation via Constraint Hypergraphs". *J. Comput. Inf. Sci. Eng.* (Apr. 4, 2025). DOI: 10.1115/1.4068375.

Submitted Manuscripts

4. Evan Taylor, John Morris, and Gregory Mocko. "Agentic Selection of Valid Multi-Fidelity Models". *Under review with J. Comput. Inf. Sci. Eng.* (Dec. 2025).

5. John Morris, Abhishek Indupally, Gregory Mocko, John Wagner, and Satchit Ramnath. "Declarative, Multi-physics Simulation Between Applications via Constraint Hypergraphs". *Under review with J. Comput. Inf. Sci. Eng.* (Oct. 2025).

6. John Morris. "ConstraintHg: A Kernel for Systems Modeling and Simulation". *Under review with Journal of Open-Source Software* (Aug. 2025).

7. John Morris, Edward Louis, Douglas L. Van Bossuyt, Gregory Mocko, and John Wagner. "Constraint Hypergraphs as a Unifying Framework for Digital Twins". *Under review with IEEE Systems Journal* (July 2025). DOI: 10.48550/arXiv.2507.05494.

Conference Publications

1. Joe Gregory and John Morris. "From Knowledge Graphs to Constraint Hypergraphs". *Submitted to 36th Annual INCOSE International Symposium*. IS 2026. INCOSE, June 13, 2026.

2. John Morris, Duncan Gibbons, Joe Gregory, and Gregory Mocko. "Technical Strategies for Semantic Aggregation of Interoperable Digital Twins". *Submitted to Conference on Systems Engineering Research*. CSER26. INCOSE, Apr. 6, 2026.

3. John Morris, Gregory Mocko, and John Wagner. "Effects of Functional and Declarative Modeling Frameworks on System Simulation". The 5th Modeling, Estimation and Control Conference (MECC 2025). IFAC, Oct. 7, 2025.

4. John Morris, Gregory Mocko, John Wagner, and Satchit Ramnath. "Declarative Integration of CAD Software into Multi-Physics Simulation via Constraint Hypergraphs". *Proceedings of the ASME 2025 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. ASME IDETC-CIE 2025. ASME, Aug. 17–20, 2025. ISBN: 978-0-7918-8920-6. DOI: 10.1115/DETC2025-168376.

5. John Morris, Dave Procopio, and John Wagner. "Dynamic Estimator of CAD Patterning Feature Execution Time". *Proceedings of the ASME 2023 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. ASME IDETC-CIE 2023. ASME, Nov. 21, 2023. https://github.com/Clemson-PLMC/PatternEstimatorTool (visited on 06/19/2024).

6. David Procopio, John Morris, and John Wagner. "Evaluation of CAE Design Change Updates–A Case Study on Gas Turbine Airflow Disruptors". *Proceedings of the ASME 2023 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. ASME IDETC-CIE 2023. American Society of Mechanical Engineers Digital Collection, Nov. 21, 2023. DOI: 10.1115/DETC2023-116761.

7. John Morris and John R. Wagner. "Application of Extracurricular Course Teaching Product Lifecycle Management Concepts to Undergraduates". 2023 ASEE Annual Conference & Exposition. June 25, 2023. DOI: 10.18260/1-2–42269.

8. David Procopio, John Morris, and John R. Wagner. "Application of Product Lifecycle Management in the University Classroom and Laboratory". 2023 ASEE Annual Conference & Exposition. June 25, 2023. DOI: 10.18260/1-2–42669.

9. Conner Eddy, Matthew Castanier, John Wagner, John Morris, and Benjamin Moss. "Usefulness and Time Savings Metrics to Evaluate Adoption of Digital Twin Technology". WCX SAE World Congress Experience. SAE International, Jan. 24, 2023. DOI: 10.4271/2023-01-0111.

Books

1. John Morris, John Wagner, and Gregory Mocko. *Product Lifecycle Management: Processes for Modern Industry*. Intended for publication by Taylor and Francis, Aug. 2026.

In Progress

1. John Morris et al. "Definitions, Methods, and Paradigms of Digital Twin Interoperability". *Intended for submission to Wiley Systems Engineering* (Mar. 2026).

2. John Morris, Joe Gregory, Duncan Gibbons, and Gregory Mocko. "Strategies for Technical Composition of Digital Twins". *Intended for submission to Software and Systems Modeling* (Feb. 2026).

3. John Morris, Abheek Chatterjee, Meredith Sutton, Douglas L. Van Bossuyt, Astrid Layton, and Gregory Mocko. "Methods for Enhancing Tradespace Exploration by Integrating Multi-Scale Simulation". *Intended for submission to Multiscale Modeling and Simulation* (Dec. 2025).

4. John Morris, Evan Taylor, Gregory Mocko, and John Wagner. "Dealing with Hallucinations: Technical Strategies for Deterministic AI". *Intended for submission to Artificial Intelligence Journal* (Dec. 2025).

Technical Reports and Theses

1. John Morris. "Universal Systems Simulation via Constraint Hypergraphs with Applications to Digital Twins". PhD thesis. Clemson University, Nov. 6, 2025.

2. John Morris and John Wagner. *2024-2025 Annual Report for the Product Lifecycle Management Center at Clemson University*. Product Lifecycle Management Center at Clemson University, Sept. 28, 2025.

3. John Morris and John Wagner. *2023-2024 Annual Report for the Product Lifecycle Management Center at Clemson University*. Product Lifecycle Management Center at Clemson University, Sept. 3, 2024.

4. John Morris, Serita Acker, Tonyia Stewart, and John Wagner. *2023 VIPR-GS Diversity, Inclusion, and Education Initiatives*. Technical Status Report. VIPR-GS Center, June 30, 2023.

Tools

1. John Morris. *MicrogridHg*. May 16, 2025. DOI: 10.5281/zenodo.15447062.

2. John Morris. *ConstraintHg*. Nov. 23, 2024. DOI: 10.5281/zenodo.15278018.

3. John Morris. *Dynamic Estimator of CAD Patterning Feature Execution Time*. Aug. 20, 2023. https://github.com/Clemson-PLMC/PatternEstimatorTool.

Presentations

1. John Morris. "Effects of Functional and Declarative Modeling Frameworks on System Simulation". The 5th Modeling, Estimation and Control Conference (MECC 2025) (Pittsburgh, PA). Oct. 7, 2025.

2. John Morris. "Universal System Simulation via Hypergraphs". Applied Category Theory Conference (ACT 2025) (Gainesville, FL). June 2, 2025.

3. John Morris. "Solving Interoperability with Digital Twins". Invited Presentation. Guest Presentation to the National Institute for Standards and Technology (Virtual). Apr. 16, 2025.

4. John Morris. "Model-Based Engineering of Digital Twins". Poster. VIPR-GS Research Center Annual Review Meeting (Greenville, SC). Feb. 26, 2025.

5. John Morris. "Representing Digital Twins". ASME IDETC-CIE: SciTechBuzz Summit 2024 (Washington DC). Aug. 26, 2024.

6. John Morris. "Application of Extracurricular Course Teaching Product Lifecycle Management Concepts to Undergraduates". 2023 ASEE Annual Conference & Exposition (Baltimore, MD). Aug. 1, 2023.

7. John Morris. "Application of Product Lifecycle Management in the University Classroom and Laboratory". 2023 ASEE Annual Conference & Exposition (Baltimore, MD). Aug. 1, 2023.

Mentored Presentations

8. William Ainsworth et al. "Development of Mechanisms Supporting Digital Twins in a Model-Based Engineering Ecosystem". Poster. Clemson University 20th Annual Focus on Creative Inquiry Forum (Clemson, SC). Apr. 2025.

9. Lia Anderson et al. "Development of Digital Twin for Scaled Robotic Vehicle". Poster. 19th Annual Focus on Creative Inquiry Forum (Clemson, SC). Apr. 3, 2024. https://ci.clemson.edu/foci/posters/.

10. Lia Anderson et al. "Exploring Digital Technologies - A Focus on PLM Concepts and Software with Application to Scale Track Vehicle". Poster. 18th Annual Focus on Creative Inquiry Forum (Clemson, SC). Apr. 2023. https://ci.clemson.edu/foci/posters2023/.

11. Clark Beuckman, Michael Calamari, Sam Gossett, Noah Wanthal, and Brenden Schumm. "PLM Processes and CAD/CAE Tools with Application to Vehicle Component Design". Poster. 17th Annual Focus on Creative Inquiry Forum (Clemson, SC). Apr. 2022.

Other Publications

1. Mara Kinsey, John Morris, and John Wagner. "A PLM-Focused, Multi-Disciplinary Creative Inquiry Course at Clemson University". *Siemens Aspire* (2022). https://view.highspot.com/viewer/6220fc66c2d0aa20acf42c3a (visited on 07/15/2025).

Awards and Recognitions

Best Poster, *VIPR-GS 2025 Annual Review Poster Forum* February 2025
Best poster in forum of 40+ describing mathematical foundations of digital twins for US Army applications

PiMT Finalist, *PiMT Department Thesis Competition* October 2024
Top three presenter at PiMT (3MT mimic) departmental competition

Buzz Award Finalist, *ASME IDETC-CIE: SciTechBuzz Summit* August 2024
Top four presenter of 30+ presentations on innovative ideas at inaugural summit

Graduate Travel Grant Award 2x, *Clemson University Graduate Student Government* July 2023; June 2025
Application-based, limited-funds award for graduate student research travel

Research Experiences

Research Assistant August 2021 – Dec 2025
Clemson University; Clemson, SC
- Posited foundation for digital twin development and deployment, solving globally recognized issues in digital twin interoperability
- Developed ConstraintHg, an open-source kernel for systems modeling and simulation that allows universal integration of system models
- Initiated and led three research projects involving researchers from institutions including the Naval Postgraduate School, the National Institute of Standards and Technology, Texas A&M, and the University of Arizona
- Developed digital twins for advanced additive manufacturing, power microgrids, an elevator lift system, a manufacturing workcell, and autonomous vehicles
- Demonstrated the first declarative integration of solid modeling, allowing CAD features to be assigned in any order

Visiting Researcher June 2025 – July 2025
National Institute of Standards and Technology (NIST); Gaithersburg, MD
- Contributed to formulation of ISO standards for digital twin interoperability
- Created digital twin of a powder-bed fusion process used to show autonomous formation of digital twin aggregates

Research Assistant: Fluid and Thermal Transport Lab Jan 2020 – Jul 2020
Brigham Young University (Dr. Julie Crockett); Provo, UT
- Conducted over 200 experiments exploring heat transfer on superhydrophobic surfaces

Teaching

Teaching Experience

PLM Applications Engineer August 2021 – Present
PLM Center at Clemson University; Clemson, SC
- Governed digital engineering initiatives and training for Department of Mechanical Engineering
- Developed and delivered over 100 seminars on digital engineering topics
- Organized and conducted workshops and training sessions teaching software tools including NX, SOLIDWORKS, MATLAB, Python, C++, Ansys, Onshape, and Teamcenter, providing hands-on learning materials and resources
- Created online, asynchronous learning resources for digital engineering via HTML-customized Canvas page with more than 25 hours worth of recorded videos, learning guides, documentations, and troubleshooting pages
- Primary author of $500,000 grant from the US Army for educational initiatives with PIs from Clemson, George Mason, Norfolk State, and South Carolina State Universities

Teaching Assistant: Computer Aided Design September 2019 – December 2020
Brigham Young University; Provo, UT
- Designed and developed learning modules to teach advanced concepts with SOLIDWORKS, including design tables, parametric modeling, surface modeling, master modeling, manufacturing drawings, and rendering
- Provided individualized tutoring for over 70 students, enhancing their proficiency in CAD design techniques and applications

Courses Taught

PLM Processes & Software Applications in Engineering Design Fall 2023
Dept. of Mechanical Engineering, Clemson University
- Senior-level/graduate elective teaching digital engineering to 40 students
- Developed curriculum, lectures, tests, assignments, and semester-long project
- Wrote 280+ page textbook to facilitate classroom learning

PLM Processes and CAD/CAE Tools with Application to Vehicle Component Design Fall 2021 – Fall 2025
Dept. of Mechanical Engineering, Clemson University
- Mentored individual research projects for nearly 50 undergraduate students
- Curriculum included presentations on digital engineering, effective scientific communication, and skills such as soldering, programming, mechatronics, networking, CAx tools, sensor integration, and 3D printing

Teaching Presentations

Seminars and Workshops Fall 2021 – Fall 2025
PLM Center at Clemson University; Clemson, SC
- Introduction to SOLIDWORKS
- Advanced SOLIDWORKS Practices
- Introduction to Siemens NX
- Teamcenter for Beginners
- Introduction to the Product Lifecycle
- Introduction to Product Lifecycle Management (PLM)
- Digital Components of PLM
- Functional Areas of PLM
- Product Design Tools and Approaches
- Data Preservation and Security
- Data Analytics and Mining
- Additive Manufacturing
- Computer-Aided Design (CAD) Methods
- Computer-Aided Engineering (CAE)
- Technical Drawings and GD&T
- Systems Simulation and Optimization
- Project Management
- Product Data Management (PDM)
- Engineering Change Management
- Model-Based Systems Engineering (MBSE)

Service and Outreach

Professional Service and Affiliations

- Member of ASME
- Member of ASME SEIKM (Systems Engineering Information & Knowledge Management) Technical Committee
  - Co-coordinator of technical session on Foundation Models and Informatics for Design & Manufacturing for ASME IDETC-CIE 2026
- Peer Reviewer:
  - INCOSE Journal of Systems Engineering (Wiley, 1x)
  - ASME Journal of Dynamic Systems, Measurement, and Control (JDSMC; 2x)
  - ASME Letters in Dynamic Systems and Control (LDSC, 1x)
  - INCOSE Conference on Systems Engineering Research (CSER, 2026)
  - ASEE Annual Conference and Exposition (2026)
  - ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC-CIE; 2025)
  - Modeling, Estimation, and Controls Conference (MECC; 2025)
- Moderator for engrXiv (Engineering Archive), an open access preprint server for engineering
- Mechanical Engineering Instructor at Project WISE summer camp for students grades 7–8
- Contributed to *Adventures in Tradespace Exploration*, workshop presented at ASME IDETC-CIE 2025
- Presenter at Graduate Student Research seminars at Clemson University (3x)

Community Service and Engagement

- Service coordinator for Clemson Engineering Design Applications and Research (CEDAR) lab (2024 – 2025)
- Volunteer peer mentor for incoming graduate students (2023 – 2025)
- Volunteer youth teacher (2018 – Present)
- Volunteer congregationalist organist/pianist (2021 – Present)
- Founding leadership of the BYU Engineering Design Club (2019 – 2021)
- Volunteer undergraduate STEM tutor (2017 – 2020)
- Full time volunteer performing religious outreach in Ghana for 2 years (2015 – 2017)

Technical Work

Powder-Bed Fusion Additive Manufacturing Digital Twin [*Link*]   Summer 2025
National Institute of Standards and Technology
Digital twin of a powder-bed fusion machine, showing full interoperability and autonomous formation of digital twin aggregates

Microgrid Digital Twin [*Link*]   Spring 2025
Clemson; Naval Postgraduate School
Digital twin of a naval microgrid demonstrating how universal simulation enables total interrogation of a physical entity

ConstraintHg Modeling Kernel [*Link*]   Fall 2024 – Present
Open-Source Python Package
Implements constraint hypergraphs for general model representation and universal simulation

Digital Twin of a Chop Saw [*Link*]   Fall 2023 – Spring 2024
Kroeger Marine Construction
A fully implemented digital twin of a 5 degree of freedom chop saw intended to be installed with a local manufacturer, integrating IoT sensors, computer vision, dynamic modeling, dashboarding, and backended with a MySQL database

NX Journal for CAD Patterning Estimation [*Link*]   Spring 2023
ASME IDETC-CIE 2023
VBA macro that dynamically estimates the length of time necessary for the system to complete a patterning operation

Digital Twin of Tracked Vehicle [*Link*]   Fall 2021 – Present
PLM Center at Clemson University
Base platform for a digital twin of a tracked robotic vehicle made in both MATLAB and Python to be able to be extended by a group of undergraduate researchers

Agent-Based Model of Pedestrian Flow through Civic Center [*Link*]   Spring 2021
Provo City Recreation Center
Combination of a Discrete Event Simulation (DES) and Agent-Based Modeling (ABM) algorithm simulating patron flow and usage of a high-volume civic center, used by the center management to decide whether to install lobby kiosks

Professional Experiences

Product Development Intern   July 2020 – April 2021
Trove Brands; Lehi, UT
- Participated in advancing engineering practices at world-leading consumer products company (BlenderBottle)
- Analyzed and identified issues in released products, recommending design improvements and optimizations

Mechanical Engineering Intern   September 2019 – January 2019
Power Innovations International; American Fork, UT
- Developed 3 project proposals for the world's first Mega-Watt Hydrogen Power system for companies including Microsoft, MTU (Rolls-Royce), and the US National Guard
- Oversaw design and modeling in converting retired municipal bus into a $150,000 Mobile Police Command Center for the city of Lehi, UT

Research and Design Intern   April 2019 – August 2019
Auxillium Automation; Provo, UT
- Collaborated with 7 engineers to design and develop a new automated shingle remover for market introduction
- Engineered 5 actuating prototypes using CAD, FDM, and CNC technologies

Founder, Head Coach, Administrator   July 2017 – June 2019
Springville Masters Swimming; Springville, UT
- Established and administrated professional adult swim team with over 20 participants, including preparing municipal project proposals, program design, website development, marketing, and local business promotions
- Provided daily workouts and technical instruction to team

Professional Skills

- Programming:
  - High proficiency with MATLAB, C++, Python, LaTeX
  - Competent with Git, PHP, HTML/CSS, JavaScript, MySQL
  - Project experience with Java, C, VBA, Android, Swift UI, R, Unix systems, Modelica, SysML
- CAD: Highly proficient in SOLIDWORKS, NX, Onshape, Autodesk Fusion 360, + API usage
- Numerical Simulation: NetLogo (Agent-Based Modeling), SimPy (Discrete Event Sim), VenSim (System Dynamics), Altair Inspire (Numerical sim), Ansys Mechanical (FEA)
- Digital Engineering: OpenCV (computer vision), Teamcenter (PDM), Dash/Plotly (dashboarding)
- General Machining: Metal machining, injection molding, FDM, SLA (3D printing)
- Mechatronics: breadboarding, robotics, sensor integration, electrical prototyping, Arduino