
EDUCATION

- **University of California, Davis** Davis, CA
Doctor of Philosophy in Computational Solid Mechanics; GPA: 4.00 2015 – 2018
 - **Minor:** Applied Mathematics
 - **Advisor:** Professor Mark Rashid
 - **Dissertation:** Partitioned Polytopal Finite-Element Methods for Nonlinear Solid Mechanics
- **University of California, Davis** Davis, CA
Master of Science in Structural Engineering & Mechanics; GPA: 4.00 2013 – 2014
 - **M.S. Project:** Applied Poromechanics for Hydraulic Fracture Simulation
- **University of California, Davis** Davis, CA
Bachelor of Science in Civil Engineering; GPA: 3.98 - Summa Cum Laude 2009 – 2013
 - **Department Citation:** Awarded by the Department of Civil & Environmental Engineering to two recipients each year, in recognition of outstanding academic achievement.

PROFESSIONAL EXPERIENCE

- **Oklahoma State University (OSU)** Stillwater, OK
Assistant Professor in the Department of Civil & Environmental Engineering 2024 – Present
- **Lawrence Livermore National Laboratory (LLNL)** Livermore, CA
Computational Mechanics Methods Developer 2018 – 2023
 - **Senior software developer of DYNA3D/ParaDyn:** a parallel, non-linear, explicit, large deformation solid and structural finite element code in Fortran, sharing the same original code base as LS-DYNA.
 - **Lead developer of BCLink:** a boundary condition remapping library in C++, for loose FSI coupling between structural and CFD analyses.
 - **Lead developer of SML:** a large deformation constitutive model library in C++, for use by both explicit and implicit thermo-mechanical HPC analysis codes.
- **McClone Construction** Shingle Springs, CA
Technical Lead 2019 - 2020
 - Software developer of FormPro: an in-house structural concrete formwork analysis tool. Assessed client needs, met regularly with stakeholders and other developers, managed code architecture considerations. Implemented core structural analysis software library in C#. Prototyped GUI and load/shear/bending/deflection graphing functionality using Mono. Developed and conducted rigorous unit testing using NUnit. Improved performance of FormPro's visualization using .NET.
- **Sandia National Laboratories** Albuquerque, NM
Graduate Technical Intern Summer 2014 & 2015
 - Developed and implemented an agglomerated polyhedral element capability within the SIERRA Solid Mechanics simulation code.
- **Sandia National Laboratories** Albuquerque, NM
Undergraduate Technical Intern Summer 2013
 - Worked with Dr. Joseph Bishop in Sandia's engineering sciences division to conduct verification testing of the Reproducing Kernel Particle Method (RKPM) in the SIERRA Solid Mechanics simulation code.
- **Structure Maintenance and Investigations - Caltrans** Sacramento, CA
Undergraduate Student Intern 2012-2013
 - Assisted in the field inspection of bridges located throughout the central valley of California. Reviewed as-built corrections and adjusted CAD-based structural plan documents. Performed load rating analyses on California bridges.

PUBLICATIONS AND SCHOLARLY ACTIVITIES

Peer-reviewed Journal Articles (published):

1. Giffin, B. D. and Zoller, M. (2024). "A layered solid finite element formulation with interlaminar enhanced displacements for the modeling of laminated composite structures." *International Journal for Numerical Methods in Engineering*. 125(23):e7581. <https://doi.org/10.1002/nme.7581>.
2. Giffin, B. D. and Zywickz, E. (2023). "A smeared crack modeling framework accommodating multi-directional fracture at finite strains." *International Journal of Fracture*. 239, 87-109. <https://doi.org/10.1007/s10704-022-00665-9>.

Peer-reviewed Journal Articles (in preparation):

1. Giffin, B. D. and Salmani, M. (in preparation). "Hyper-dimensional contact gap methods: theory and numerical discretization." *Computational Mechanics*.
2. Giffin, B. D. (in preparation). "Bit-reversible time integrations for dissipative dynamic systems." *International Journal for Numerical Methods in Engineering*.
3. Poudel, H., and Giffin, B. D. (in preparation). "Physics-based modeling and fragility analysis of transmission towers under tornado-induced wind and debris impact loading." *Journal of Wind Engineering and Industrial Aerodynamics*.

Conference Papers:

1. Giffin, B. D. (2024). "Hyper-dimensional gap finite elements for the enforcement of interfacial constraints." *16th World Congress on Computational Mechanics*. [10.23967/wccm.2024.109](https://doi.org/10.23967/wccm.2024.109).
2. Kenawy, M. and Giffin, B. D. (2024). "Model-Based Uncertainty in Predicting Damage to Near-Fault Reinforced Concrete Structures." *18th World Congress on Earthquake Engineering*. https://www.mahakenawy.com/_files/ugd/e274d3_b4dfd379f6d34758b4e578b1085460cf.pdf.

Dissertation and Reports:

1. Castonguay, S., Giffin, B., Hathaway, R., Zoller, M. (2023). "Shared Material Library User Documentation - Version 23.0." *Lawrence Livermore National Laboratory*. LLNL-SM-854936.
2. Giffin, B. D. (2022). "BCLink User Documentation" *Lawrence Livermore National Laboratory*. LLNL-TR-840326. <https://doi.org/10.2172/1889533>.
3. Giffin, B. D. (2020). "Shell Element Material Model Verification Problems for DYNA3D: Part II." *Lawrence Livermore National Laboratory*. LLNL-TR-814964. <https://doi.org/10.2172/1668518>.
4. Giffin, B. D. (2019). "Shell Element Material Model Verification Problems for DYNA3D." *Lawrence Livermore National Laboratory*. LLNL-TR-792469. <https://doi.org/10.2172/1569660>.
5. Giffin, B. D. (2019). "Verification Problems for Parameterized Load Curves in DYNA3D." *Lawrence Livermore National Laboratory*. LLNL-TR-765860. <https://doi.org/10.2172/1499983>.
6. Giffin, B. D. (2018). "Partitioned Polytopal Finite-Element Methods for Nonlinear Solid Mechanics." Ph.D. Dissertation. *University of California, Davis*. <https://www.proquest.com/docview/2091485390?sourcetype=Dissertations%20&%20Theses>.
7. Giffin, Brian D. (2015). "Verification Tests for Sierra/SM's Reproducing Kernel Particle Method." *Sandia National Laboratories*. SAND2017-12869. <https://doi.org/10.2172/1411850>.
8. Giffin, B. D. (2014). "Applied Poromechanics for Hydraulic Fracture Simulation." M.S. Project Report. *University of California, Davis*.

Conference Presentations and Posters:

1. Poudel, H. and Giffin, B. D. (2025). “Fragility Analysis of Transmission Towers through Physics-Based Modeling of Tornado-Induced Wind and Debris Impact Loads.” Oral presentation (co-author), *NHERI Computational Symposium*, February 5-7, Los Angeles, CA.
2. Giffin, B. D. (2024). “Hyper-dimensional gap finite elements for the enforcement of interfacial constraints.” Oral presentation (presenter), *16th World Congress on Computational Mechanics*, July 21-26, Vancouver, BC.
3. Zoller, M. and Giffin, B. D. (2024). “A layered solid finite element formulation with interlaminar enhanced displacements for the modeling of laminated composite structures.” Oral presentation (co-author), *16th World Congress on Computational Mechanics*, July 21-26, Vancouver, BC.
4. Kenawy, M. and Giffin, B. D. (2024). “Model-Based Uncertainty in Predicting Damage to Near-Fault Reinforced Concrete Structures.” Oral presentation (co-author), *18th World Congress on Earthquake Engineering*, June 30 - July 5, Milan, Italy.
5. Giffin, B. D. (2022). “Elasto-Plastic Hourglass Control for Physically Stabilized Non-Linear Finite Elements with Reduced Integration.” Oral presentation (presenter), *Engineering Mechanics Institute Conference*, May 31-June 3, Baltimore, MD.
6. Giffin, B. D. (2021). “A Smeared Crack Modeling Framework Accommodating Multi-directional Fracture at Finite Strains.” Oral presentation (presenter), *Engineering Mechanics Institute Conference*, May 25-28, virtual event.
7. Giffin, B. D. (2019). “A stable, efficient, locking free hexahedral element for problems in non-linear dynamics.” Oral presentation (presenter), *Engineering Mechanics Institute Conference*, June 18-21, Pasadena, CA.
8. Giffin, B. D. and Rashid, M. (2017). “An Improved Partitioned Element Method for Constructing Higher-Order Shape Functions on Arbitrary Polyhedra.” Oral presentation (presenter), *14th U.S. National Congress on Computational Mechanics*, July 17-20, Montreal, Canada.
9. Bishop, J. E., Giffin, B. D., and Pott, J. (2013). “Verification of a Convergent Meshless Method in Sierra Solid Mechanics.” Poster presentation (presenter), *Sandia Intern Symposium*, August 6, Albuquerque, NM.

ACADEMIC AND PROFESSIONAL LEADERSHIP

- **Chi Epsilon**
Active member 2024 – present
- **American Society of Civil Engineers (ASCE)**
Active member 2012 – present
- **Computational Mechanics (journal)**
Peer reviewer 2024
- **Earthquake Engineering Research Institute** 12th National Conference on Earthquake Engineering
Peer reviewer for technical conference papers 2022
- **National Student Steel Bridge Competition (NSSBC)** ASCE Mid-Pacific Student Conference
Regional Competition Judge 2022
- **Computational Mechanics Working Group (CMWG)** UC Davis
Co-founder, President 2016 – 2018
 - Organized a community of graduate students at UC Davis to meet and discuss research related interests in the field of computational mechanics. Invited speakers from LLNL and LBNL to come share their current projects and interests with the group.

- **National Student Steel Bridge Team at UC Davis** UC Davis
Project Manager 2012 – 2013
 - Led a team of 20 undergraduate engineering students in the design and fabrication of a 20ft steel bridge as part of the National Student Steel Bridge Competition (NSSBC). Claimed 2nd place overall at the Mid-Pacific regional competition; ranked 3rd place overall at the national competition.
- **American Society of Civil Engineers (ASCE) Student Chapter** UC Davis
Events and Activities Coordinator 2012 – 2013

HONORS AND AWARDS

- **NHERI Primary Travel Award** 2024
NHERI Natural Hazards Research Summit
- **Graduate Studies Travel Award** 2017
University of California, Davis - Graduate Studies
- **Academic Achievement Award** 2013
American Society of Civil Engineers (ASCE) Sacramento Section
- **Civil & Environmental Engineering Departmental Citation Award** 2013
UC Davis Department of Civil & Environmental Engineering
- **3rd Place Overall - National Student Steel Bridge Competition** 2013
National Student Steel Bridge Competition (NSSBC)
- **SEAOCC Student Scholarship** 2012
Structural Engineers Association of Central California (SEAOCC)
- **Outstanding Student Award** 2012
American Society of Civil Engineers (ASCE) Sacramento Section

RESEARCH EXPERIENCE

- **Research and development of novel finite element methods** LLNL
Various ParaDyn-related projects 2018 – 2023
 - Developed and implemented a novel solid element formulation for improved bending performance, specialized for use in explicit dynamics simulations (presented at EMI).
 - Formulated a laminated solid element for use in the modeling of laminated composites (publication in IJNME).
 - Developed an improved (naturally stable) formulation of the 10-node composite tetrahedron element for rapid analysis needs.
 - Devised a novel elasto-plastic hourglass stabilization method for finite elements with reduced integration (presented at EMI).
- **Research and development of novel constitutive modeling approaches** LLNL
Various ParaDyn-related projects 2018 – 2023
 - Formulated and implemented a large deformation material modeling framework accommodating multi-directional failure (publication in IJF).
 - Formulated and implemented a novel logarithmic strain-based temperature-dependent, hybrid visco-plastic/visco-elastic material model.
- **Incremental kinematic algorithms for large deformation analyses** UC Davis
Graduate research 2016 – 2018
 - Investigated the accuracy of alternative incremental kinematic algorithms used by hypo-elastic constitutive models. Formulated an improved algorithm for efficiently evaluating matrix functions used in high-accuracy kinematic algorithms.

- **Partitioned polytopal finite-element methods for nonlinear solid mechanics** UC Davis
Ph.D. Dissertation 2015 – 2018
 - Developed a high-order arbitrary polyhedral element method for improved accuracy in the modeling of thin geometries.
 - Implemented a novel finite deformation polyhedral finite element method in a self-authored Fortran-based research code, and demonstrated notable improvements in mesh quality and solution accuracy.
- **Agglomerated polyhedral finite elements** Sandia National Labs
Summer research project 2014 – 2015
 - Developed and implemented a method for aggregating tetrahedral elements into arbitrary polyhedral elements, utilizing existing domain decomposition methods via METIS. Implemented an agglomerated polyhedral element capability within the SIERRA Solid Mechanics simulation platform. The element formulation was largely based upon the “partitioned element method” (the subject of my dissertation), and capable of handling polyhedra generated from arbitrary aggregations of tetrahedra. The method was demonstrated to provide improved accuracy in large deformation elasto-plastic impact problems.
- **Poromechanical simulation methods for hydraulic fracture** UC Davis
M.S. Project 2014
 - Collaborated with Lawrence Livermore National Laboratory’s Computational Geosciences Group, investigating the use of continuum damage models for simulating hydraulically driven fracture. The project culminated in the implementation of a coupled poromechanics physics solver within the GEOS finite element code.

TEACHING AND MENTORING EXPERIENCE

- **Oklahoma State University** Stillwater, OK
Course Instructor: CIVE 5010 - Finite Element Analysis of Solids and Structures Spring 2025
 - Graduate-level course: prepared original course lecture notes, homework assignments, exams, and supplementary educational materials.
- **Oklahoma State University** Stillwater, OK
Course Instructor: CIVE 5403 - Advanced Strength of Materials Fall 2024
 - Graduate-level course: prepared original course lecture notes, homework assignments, exams, and supplementary educational materials.
- **Oklahoma State University** Stillwater, OK
Course Instructor: CIVE 5423 - Matrix Analysis of Structures Spring 2024
 - Graduate-level course: prepared original course lecture notes, homework assignments, exams, and supplementary educational materials.
- **National Student Steel Bridge Team at Oklahoma State University** OSU
Faculty Advisor 2024 – present
 - Provided consultation to undergraduate students regarding design, project management, and participation in the NSSBC.
- **College of Engineering Mentor Collective** UC Davis
Academic Mentor 2020 – 2021
 - Mentored first year undergraduate students at UC Davis, providing academic and career guidance during the 2020-21 academic year.
- **University of California, Davis** Davis, CA
Substitute Lecturer 2017

- Served as a substitute lecturer for the *Mechanics of Materials* undergraduate course on behalf of Professor Bassam Younis, and Professor Sabbie Miller.

- **University of California, Davis** Davis, CA
Course Instructor: ENG 35 - Engineering Statics *Fall 2015*
 - Independently organized and taught an undergraduate engineering course of 118 students. Managed a team of 5 teaching assistants and 2 graders. Prepared original course lecture notes, homework assignments, exams, and supplementary educational materials.
- **National Student Steel Bridge Team at UC Davis** UC Davis
Graduate Advisor *2014 – 2018*
 - Provided consultation to undergraduate students regarding design and fabrication processes. Helped the team to claim 1st place overall at the national competition (2014).
 - Recorded a series of videos demonstrating design principles in AutoCAD and SAP2000, intended for students participating in the National Student Steel Bridge Competition (NSSBC). (<https://www.youtube.com/@briangiffin6640>)
 - Developed a collection of VBA-based automated structural design and optimization tools utilizing the AutoCAD and SAP2000 APIs, intended for students participating in the National Student Steel Bridge Competition (NSSBC). (<https://github.com/bdgiffin/SBDesignTools>)
- **University of California, Davis** Davis, CA
Teaching Assistant *2013 – 2018*
 - Assisted lecturing, hosted laboratory sessions, held office hours, and graded assignments for the following courses: *Introduction to Civil Engineering*, *Mechanics of Materials*, *Finite Element Procedures in Applied Mechanics*

OPEN-SOURCE RESEARCH AND EDUCATIONAL SOFTWARE PROJECTS

- **Structural Wind-borne Impact Risk assessment Library (SWIRL)** *2024 – present*
<https://github.com/bdgiffin/SWIRL>
 - Physics-based fluid-structure-debris modeling framework, developed to investigate and quantify the extent to which wind-borne debris impact contributes to structural damage and collapse. Accompanying documentation aims to facilitate broader adoption, collaboration, and integration with existing NHERI SimCenter computational infrastructure.
- **Interactive Earthquake Simulator - Cohesive Zone Model (CZM) library** *2020 – present*
<https://github.com/bdgiffin/CZM>
 - Independently developed an educational, open-source, earthquake simulator. Users first “paint” a structure on a pixelated 2D canvas (a la Minecraft), and then subject their design to a dynamically simulated earthquake (using recorded motions taken from the PEER Ground Motion Database). Brittle damage and failure is modeled using cohesive zone elements, incorporating real-time simulation and rendering via OpenGL.
- **Interactive Multi-Physics Analysis in Real-Time (IMPART)** *2020 – present*
<https://github.com/bdgiffin/IMPART>
 - Independently developed an educational, open-source, 2D thermo-mechanical physics engine, incorporating real-time simulation and rendering via OpenGL. Users can interactively control the analysis to investigate the effects of: large deformations, heat transfer and thermal expansion, dynamic impact, frictional contact, gravitational and buoyant forces, bulk viscosity, and element erosion.
- **NSSBC Bridge Designer** *2017 – present*
<https://github.com/bdgiffin/BridgeDesigner>

- Developed a MATLAB-based 3D structural analysis and optimization tool, intended for students participating in the National Student Steel Bridge Competition (NSSBC). Students can import and export designs to/from AutoCAD, run linear elastic analyses, buckling analyses, evaluate design efficiency, and improve designs using a gradient-based optimization approach to select (discrete) member section sizes.

MEDIA APPEARANCES

- **OSU - CIVE “Get to know your faculty” series** 2024
<https://ceat.okstate.edu/cive/get-to-know-your-faculty.html>
- **News 9 in Oklahoma City** 2024
<https://www.news9.com/story/6648202d80caabd8822f1a79/osu-researchers-gather-storm-damage-data>

LICENSES AND CERTIFICATIONS

- **Engineer in Training** 2023
California Board for Professional Engineers, Land Surveyors, and Geologists Certificate # EIT 178316

KNOWLEDGE, SKILLS, AND RESEARCH INTERESTS

- **Technical Expertise and Research Interests:** Computational solid mechanics, large deformation kinematics, finite elements and novel discretization methods, nonlinear transient dynamics, contact mechanics, numerical modeling of fracture, poromechanics, constitutive model development, structural analysis, design optimization, natural hazards engineering
- **Programming Languages:** C++, C#, Fortran, Matlab, Python, VBA, .NET
- **Software Development:** High performance computing (HPC), GPGPU, Git, CVS, Agile methodologies, Unix, shell scripting, L^AT_EX, GNU Make, CMake, GUI, OpenGL, OpenACC, OpenMP, GitLab CI/CD, unit testing, V&V, Eclipse, Visual Studio, Mono, TotalView
- **Engineering Software:** AutoCAD, MicroStation, SAP2000, DYNA3D/ParaDyn, SIERRA Solid Mechanics, Abaqus, ANSYS, SolidWorks, Cubit, ParaView, Enight, VisIt