

Education

Doctor of Philosophy in Computer Science

Emphasis: Software Engineering

Dissertation: “Decay and Grime Buildup in Evolving Object Oriented Design Patterns”

Colorado State University, Fort Collins, Colorado

Graduation: 2009

Master of Science in Computer Science

Emphasis: Artificial Intelligence

Thesis: “An Emergent Architecture for Use in Navigational Planning and Environment Learning”

Montana State University, Bozeman, Montana

Graduation: 1993

Bachelor of Mathematics

University of Wollongong, New South Wales, Australia

Graduation: 1987

Professional Experience

Montana State University – **Bozeman, Montana, 2017 - Current**

- **Gianforte School of Computing**
- **Joint Appointment, Idaho National Laboratories (Nov. 2020 – present)**
- **Associate Professor (*tenured*)**
 - Teach software engineering, undergraduate research, and other classes as assigned.
 - Conduct research in software engineering, QA, Technical Debt
 - Collaborate with other departments
 - Develop the Software Factory initiative with high tech partners

Carnegie Mellon University – **Pittsburgh, Pennsylvania, January 2019 – May 2019 (*Spring Semester*)**

- **Software Engineering Institute (SEI)**
- **Invited Sabbatical**
 - Research in software engineering architecture with CMU, SEI faculty

Montana State University – **Bozeman, Montana, 2011 - 2017**

- **Department of Computer Science**
- **Assistant Professor**
 - Teach software engineering, undergraduate research, and other classes as assigned.
 - Conduct research in software engineering and interdisciplinary efforts
 - Establish a successful research program

Universidad de Concepcion (UdeC) – **Concepcion, Chile, May 2013 – July 2013 (*Spring Semester*)**

- **Department of Computer Science**
- **Invited Visiting Assistant Professor**
 - Teach software engineering and engage in research with UdeC faculty

Carroll College of Montana – **Helena, Montana, August 2010 – December 2010 (*Fall Semester*)**

- **Department of Computer Science**
- **Adjunct Professor of Software Engineering**

- Collaboration with Carroll College to deliver the junior standing Software Engineering class through distance learning.

Montana State University – **Bozeman, Montana, 2009 - 2011**

- **Department of Computer Science**
- **Associate Research Professor**
 - Teach software engineering, undergraduate research, and other classes as assigned
 - Conduct research in software engineering and ecological and environmental sciences

Montana State University – **Bozeman, Montana, 2008 - 2010**

- **Department of Land Resources and Environmental Sciences**
- **Research Scientist**
 - Design and Architect modeling software systems for landscape flux networks.

Montana State University – **Bozeman, Montana, 2008 - 2009**

- **Department of Computer Science**
- **Adjunct Instructor**
 - Teach 300 and 400 level software engineering classes.

Hewlett-Packard Company – **Fort Collins, Colorado, 2007 – 2009**

- **Storage Works Division Research Laboratories**
 - Member of the Near line storage design team
 - Research Java architectures and code for storage products
 - Handle customer escalations for various Fortune 100 companies worldwide
 - Responsible for the success of partnerships with collaborating companies

Colorado State University – **Fort Collins, Colorado, Fall 2007 Semester**

- **Department of Computer Science**
- **Teaching Assistant**
 - Taught 500 level distance learning course in software engineering

Intel Company – **Fort Collins, Colorado, 2005 - 2007**

- **VLSI Research and Development Laboratories, Fort Collins Design Center**
 - Member of the Itanium Microchip team
 - Design and research of VLSI infrastructure for electrical circuit recognition CAD tools

Hewlett-Packard Company – **Fort Collins, Colorado, 1993 - 2004**

- **VLSI Research and Development Laboratories, Microprocessor Technology Division**
 - Member of the Itanium Microchip team.
 - Design and research of VLSI frameworks for Computer Aided Design (CAD) tools
 - Development of Information and Data Models to represent microchip data
 - Development of Object Oriented Models to represent layout and schematics of microchips
- **Systems And Software Research And Development Laboratories**
 - Distributed applications research and development using MS technologies
 - Research and development of web based middleware solutions
 - Development of prototype systems to showcase various technologies to store information, communications protocols, queuing theory, etc.
 - Specific technologies studied include BizTalk, XmlRpc, MSMQ, Shared Memory Systems in UNIX, ASP, etc.
- **Unix Research And Development Laboratories**
 - Developer of HP/DCE Configuration Management tools for distributed computing
 - Research in integrating HP Systems Administration Tool (SAM) with NIS+ namespace technology

- Research on distributed architecture to merge SAM with external administration tool (OpenView/ITA)
- Develop distributed application programming interface (API) to support SAM
- Investigation and development of monitoring and management technologies for systems. Technologies include CA, ITO, ITA, SAM, EMS, Flipper, WBEM, and DMI

Montana State University – Bozeman, Montana, 1991 - 1993

- **Department of Computer Science**
 - Research Assistant in Artificial Intelligence. Worked on investigations with genetic algorithms and neural networks to predict grasshopper populations
- **Department of Computer Science**
 - Teaching Assistant. Taught 100-200 level classes in C, Pascal computer languages and data structures

FourGen Software Technologies – Seattle, Washington, 1990

- Information Systems programming using 4GL languages
- Systems Administration of a Laboratory consisting of approximately 30 users running on Sequent systems under Dynix

Utah State University – Logan, Utah, 1989

- Department of Electrical Engineering
- Development and research of a system for viewing statistical data in 3D

ForeSearch Software Pty. Ltd. – Sydney, Australia, 1988 - 1989

- UNIX systems administration and programming.
- Information Systems programming using C, and 4GL languages.

Professional and Technical Skills

- **Leadership:** Graduate 2018 academic year. Developing Excellence in Academic Leadership (DEAL), Faculty Senator
- **Programming Languages:** C, C++, R, Java, Pascal, LISP, SQL, 4GLs, K-Shell, Declarative languages, COM
- **Operating Systems:** Various Flavors of Unix, MS-DOS, Windows, NT, XP
- **Development Tools:** Traditional Unix tools, Softbench, DDE, Eclipse, ClearCase, MS Visual Studio , R Studio, various layout design editors for microchip design
- UML and Design Patterns
- Software Modeling
- **Professional**
 - National Science Foundation (NSF) reviewer/panelist.
 - Science reviewer for grants in Canada, Chile.
 - Proven experience leading large software development efforts with > \$3M budgets and > 20 staff
 - Experience writing quality plans, reference specifications, test plans
 - Significant experience working with various partner laboratories across various cultures and geographies
 - Significant experience working with numerous external HP customers and engineering partners such as US West, Motorola, Loral Systems, MCI, Colorado State University, Eastman Kodak, NexCom, Oracle, Computer Associates, Microsoft, Siemens Nixdorf
 - Responsible for overall releases of software products
 - Significant experience with technical presentations to private industry and academia

Publications

In Progress

1. Reimanis D., Izurieta C., “*A Study of Behavioral Decay in Design Patterns*,” IEEE Transactions: Under Review
2. Izurieta C., “*Design Patterns and Reusability*,” multi-volume book *Realizing Complex Integrated Systems* by CRC Press Taylor and Francis Group: In Progress
3. Reinhold A.M., Raile E., Izurieta C., McEvoy J., King H., Poole G., Ready R., Bergmann N., Shanahan E., “*Persuasion with Precision: A Mixed Methods Approach to Improving Validity in Risk Communication Treatment Conditions*,” Journal of Mixed Methods Research: Under Review

Refereed Conferences

1. Guerledo C. et al., Izurieta C., “*Technical Debt is not Only about Code and We Need to be Aware about It*,” SBQS 2021, Brazilian Symposium on Software Quality, November 2021. Distinguished Paper Award.
2. Rehman F., Izurieta C., “*A Hybridized Approach for Testing Neural Network Based Intrusion Detection Systems*,” IEEE SmartNets 2021 -CyberSec CIIA International Conference, (Virtual) Glasgow Scotland, September 22-24, 2021
3. Rehman F., Izurieta C., “*Statistical Metamorphic Testing of Neural Network Based Intrusion Detection Systems*,” IEEE International Conference on Cybersecurity and Resilience CSR July 26-28, 2021 (online).
4. Freire S., et al., Izurieta C., “*How Experience Impacts Practitioner’s Perception of Causes and Effects of Technical Debt*,” 14th IEEE International Conference on Cooperative and Human Aspects of Software Engineering, CHASE 2021, March 20-21, 2021.
5. Freire S., Rios N., Perez B., Correal D., Izurieta C., Seaman C., Spinola R., “*How do Technical Debt Payment Practices Relate to the Effects of the Presence of Debt Items in Software Projects?*,” 28th IEEE International Conference on Software Analysis, Evolution and Reengineering, SANER 2021, Virtual (Honolulu, HI, USA) March 9-12, 2021.
6. Freire S., Rios N., Perez B., Correal D., Mendonca M., Izurieta C., Seaman C., Spinola R., “*Surveying Software Practitioners on Technical Debt Payment Practices and Reasons for not Paying off Debt Items*,” 24th International Conference on Evaluation and Assessment in Software Engineering, EASE 2020, Trondheim, Norway, April 15-17, 2020.
7. Freire S., Rios N., Mendonca M., Falessi D., Seaman C., Izurieta C., Spinola, R., “*Actions and Impediments for Technical Debt Prevention: Results from a Global Family of Industrial Surveys*,” 35th ACM/SIGAPP Symposium on Applied Computing, Brno, Czech Republic, March 30 – April 3, 2020
8. Rios N., Mendes L., Cardeiral C., Magalhaes A., Perez B., Correal D., Astudillo H., Seaman C., Izurieta C., Santos G., Spinola R., “*Hearing the Voice of Software Practitioners on Causes, Effects, and Practices to Deal with Documentation Debt*,” 26th Intl. Conference on Requirements Engineering: Foundation for Software Quality, REFSQ 2020, Pisa, Italy, March 24-27, 2020.
9. Izurieta C., Reimanis D., Griffith I., Schanz T., “*Structural and Behavioral Taxonomies of Design Pattern Grime*,” 12th Seminar on Advanced Techniques & Tools for Software Evolution. SATToSE 2019, Vol. 2510, ISSN 1613-0073, <http://eur-ws.org/Vol-2510>, Bolzano, Italy, July 8-10, 2019.
10. Reimanis D., Izurieta C., “*Behavioral Evolution of Design Patterns: Understanding Software Reuse through the Evolution of Pattern Behavior*,” 18th International Conference on Software Systems and Reuse, ICSR 2019. In: Peng X., Ampatzoglou A., Bhowmik T. (eds) Reuse in the Big Data Era. Vol 11602, Springer Cham. Cincinnati, OH, June 26-28 2019.
11. Izurieta C., Prouty M., “*Leveraging SecDevOps to Tackle the Technical Debt Associated with Cybersecurity Attack Tactics*,” ACM-IEEE Second International Conference on Technical Debt, TechDebt 2019, Montreal, Canada, May 26-27, 2019.
12. Izurieta C, Gunderson-Izurieta S., “*An Experiential Report on Using a Software Factory in a Rural State to Promote Entrepreneurship*,” Technology and Engineering Management Society Conference, TEMSCON 2018, Evanston IL, June 27 – July 1 2018.
13. Izurieta C, Rice D., Kimball K., Valentien T., “*A Position Study to Investigate Technical Debt Associated with Security Weaknesses*,” ACM-IEEE First International Conference on Technical Debt, TechDebt 2018, Gothenburg, Sweden, May 27-28, 2018.

14. Griffith I., Izurieta C., Huvaere C., "An Industry Perspective to Comparing the SQALE and Quamoco Software Quality Models," 11th ACM-IEEE International Symposium on Empirical Software Engineering and Measurement, ESEM 2017, Toronto, Canada, November 9-10, 2017.
15. Perreault L., Berardinelli S., Izurieta C., Sheppard J., "Using Classifiers for Software Defect Detection," 26th International Conference on Software Engineering and Data Engineering, SEDE 2017, San Diego, California, October 2-4, 2017.
16. Rojas G., Izurieta C., Griffith I., "Toward Technical Debt Aware Software Modeling," IEEE-ACM Ibero American Conference on Software Engineering, CibSE 2017, Buenos Aires, Argentina, May 22-23 2017.
17. Izurieta C., Ozkaya I., Seaman C., Kruchten P., Nord R., Snipes W., Avgeriou P., "Perspectives on Managing Technical Debt. A Transition Point and Roadmap from Dagstuhl," 1st International Workshop on Technical Debt Analytics (TDA). In association with the 23rd Asia-Pacific Software Engineering Conference (APSEC). University of Waikato, Hamilton, New Zealand, December 6-9 2016.
18. Reimanis D., Izurieta C., "Towards Assessing the Technical Debt of Undesired Software Behaviors in Design Patterns," IEEE ACM MTD 2016 8th International Workshop on Managing Technical Debt. In association with the 32nd International Conference on Software Maintenance and Evolution, ICSME, Raleigh, North Carolina, October 4, 2016.
19. Izurieta C., O'Bleness M., Trenk M., Gunderson-Izurieta S., "The Effectiveness of Software Development Instruction through the Software Factory Method for High School Students," ASEE '16, 123rd Annual Conference in Engineering and Education, New Orleans, June 26-29, 2016.
20. Carroll C., Falessi D., Forney V., Frances A., Izurieta C., Seaman C., "A Mapping Study of Software Causal Factors for Improving Maintenance," 9th ACM-IEEE International Symposium on Empirical Software Engineering and Measurement, ESEM 2015, Beijing, China, October 22-23, 2015.
21. Reimanis D., Izurieta C., "A Research Plan to Characterize, Evaluate, and Predict the Impacts of Behavioral Decay in Design Patterns," IEEE ACM IDoESE, 13th International Doctoral Symposium on Empirical Software Engineering, Beijing, China, October 19 2015.
22. Assefi M., Liu G., Izurieta C., Wittie M.P., "An Experimental Evaluation of Apple Siri and Google Speech Recognition," 24th International Conference on Software Engineering and Data Engineering, SEDE 2015, San Diego, California, October 12-14, 2015.
23. Goel U., Izurieta C., Wittie M.P., "Understanding Factors Influencing the Citation Count of Networking Conference Papers," 24th International Conference on Software Engineering and Data Engineering, SEDE 2015, San Diego, California, October 12-14, 2015.
24. Izurieta C., Rojas G., Griffith I., "Preemptive Management of Model Driven Technical Debt for Improving Software Quality," 11th International ACM SigSoft Conference on the Quality of Software Architectures, QoSA 2015, Montreal, Canada, May 4-8, 2015.
25. Griffith I., Izurieta C., Taffahi H., Claudio D., "A Simulation Study of Practical Methods for Technical Debt Management in Agile Software Development," Winter Simulation Conference WSC 2014, Savannah, GA, December 7-10, 2014.
26. Griffith I., Reimanis D., Izurieta C., Codabux Z., Deo A., Williams B., "The Correspondence between Software Quality Models and Technical Debt Estimation Approaches," IEEE ACM MTD 2014 6th International Workshop on Managing Technical Debt. In association with the 30th International Conference on Software Maintenance and Evolution, ICSME, Victoria, British Columbia, Canada, September 30, 2014.
27. Reimanis D., Izurieta C., Luhr R., Xiao L., Cai Y., Rudy G., "A Replication Case Study to Measure the Architectural Quality of a Commercial System," 8th ACM-IEEE International Symposium on Empirical Software Engineering and Measurement, ESEM 2014, Torino, Italy, September 2014.
28. Griffith I., Izurieta C., "Design Pattern Decay: The Case for Class Grime," 8th ACM-IEEE International Symposium on Empirical Software Engineering and Measurement, ESEM 2014, Torino, Italy, September 2014.
29. Dale M., Izurieta C., "Impacts of Design Pattern Decay on System Quality," 8th ACM-IEEE International Symposium on Empirical Software Engineering and Measurement, ESEM 2014, Torino, Italy, September 2014.

30. Griffith I., Izurieta C., “*Design Pattern Decay: An Extended Taxonomy and Empirical Study of Grime and its Impact on Design Pattern Evolution*,” IEEE ACM IDoESE, 11th International Doctoral Symposium on Empirical Software Engineering, Baltimore, USA, October 9th, 2013.
31. Luhr R., Reimanis D., Cross R., Izurieta C., Poole G.C., Helton A., “*Natural Science Visualization Using Digital Theatre Software*,” IEEE ICISA 2013 International Conference on Information Science and Applications, Pattaya, Thailand, June 24-26, 2013.
32. Izurieta C., Griffith I., Reimanis D., Luhr R., “*On the Uncertainty of Technical Debt Measurements*,” IEEE ICISA 2013 International Conference on Information Science and Applications, Pattaya, Thailand, June 24-26, 2013.
33. Morrison-Smith S., Marmon C., Dighans S., Daniels T., Izurieta C., “*Technical Debt Reduction Using a Game Theoretic Competitive Source Control Approach*,” ISCA 25th International Conference on Computer Applications in Industry and Engineering, CAINE '12, New Orleans, Louisiana, November 2012.
34. Izurieta C., Poole G., Payn R.A., Griffith I., Nix R., Helton A.M., Bernhardt E., Burgin A.J., “*Development and Application of a Simulation Environment (NEO) for Integrating Empirical and Computational Investigations of System-Level Complexity*.” IEEE ICISA 2012 International Conference on Information Science and Applications, Suwon, Korea, May 23-25, 2012.
35. Izurieta C., Vetro A., Zazworka N., Cai Y., Seaman C., Shull F., “*Organizing the Technical Debt Landscape*.” IEEE ACM MTD 2012 3rd International Workshop on Managing Technical Debt. In association with the 34th International Conference on Software Engineering ICSE, Zurich, Switzerland, June 2-9, 2012.
36. Seaman C., Guo Y., Izurieta C., Cai Y., Zazworka N., Shull F., Vetro A., “*Using Technical Debt Data in Decision Making: Potential Decision Approaches*.” IEEE ACM MTD 2012 3rd International Workshop on Managing Technical Debt. In association with the 34th International Conference on Software Engineering ICSE, Zurich, Switzerland, June 2-9, 2012.
37. Griffith I., Wahl S., Izurieta C., “*Evolution of Legacy System Comprehensibility through Automated Refactoring*.” IEEE ACM MALETS 2011 International Workshop on Machine Learning Technologies in Software Engineering. In association with the 26th International Conference on Automated Software Engineering ASE, Lawrence, Kansas, November 7-12, 2011.
38. Griffith I., Wahl S., Izurieta C., “*TrueRefactor: An Automated Refactoring Tool to Improve Legacy System and Application Comprehensibility*.” ISCA 24th International Conference on Computer Applications in Industry and Engineering, CAINE '11, Honolulu, HI, November 2011.
39. Strasser S., Frederickson C., Fenger K., Izurieta C., “*An Automated Software Tool for Validating Design Patterns*.” ISCA 24th International Conference on Computer Applications in Industry and Engineering, CAINE '11, Honolulu, HI, November 2011.
40. Strasser S., Sheppard J., Schuh M., Angryk R., Izurieta C., “*Graph-Based Ontology-Guided Data Mining for D-Matrix Model Maturation*”. IEEE Aerospace Conference AIAA Technical Co-Sponsor, IEEEAS '11, Big Sky, Montana, USA, March 5-12, 2011.
41. Schuh M., Sheppard J., Strasser S., Angryk R., Izurieta C. “*Ontology-Guided Knowledge Discovery of Event Sequences in Maintenance Data*.” IEEE AutoTestCon Conference 2011, Baltimore, Maryland, USA, September 12-15, 2011.
42. Izurieta C., Poole G.C., McGlynn B.L., Cross W.F., Marshall L.A., Jacobs G.A., Cleveland S., Judson I., Hauer F.R., Kucera B., “*A Cyber-Infrastructure for a Virtual Observatory and Ecological Informatics System –VOEIS*”. 2010 AGU Meeting, San Francisco, USA, December 13-17 2010.
43. Schanz T., Izurieta C. “*Object Oriented Design Pattern Decay: A Taxonomy*”. 4th ACM-IEEE International Symposium on Empirical Software Engineering and Measurement, ESEM '10, Bolzano-Bozen, Italy, September 2010.
44. Norick B., Krohn J., Howard E., Welna B., Izurieta C. “*Effects of the Number of Developers on Code Quality in Open Source Software: A Case Study*”. Short paper/poster. 4th ACM-IEEE International Symposium on Empirical Software Engineering and Measurement, ESEM '10, Bolzano-Bozen, Italy, September 2010.

45. Nurseitov N., Paulson M., Reynolds R., Izurieta C. “*Comparison of JSON and XML Data Interchange Formats: A Case Study*”. 22nd International Conference on Computer Applications in Industry and Engineering, CAINE '09, San Francisco, CA, November 2009.
46. Izurieta C., Bieman J.M. “*Testing Consequences of Grime Buildup in Object Oriented Design Patterns*”. 1st ACM-IEEE International Conference on Software Testing, ICST '08, Lillehammer, Norway, April 2008.
47. Izurieta C., Bieman J.M. “*How Software Designs Decay: A Pilot Study of Pattern Evolution*”. 1st ACM-IEEE International Symposium on Empirical Software Engineering and Measurement, ESEM '07, Madrid, Spain, September 2007.
48. Izurieta C. “*Case Study: A Tool Centric Approach for Fault Avoidance in Microchip Designs*”. 16th International Conference on Software Engineering and Data Engineering, SEDE '07, Las Vegas, NV, July 2007.
49. Izurieta C., Bieman J.M. “*The Evolution of FreeBSD and Linux*”. 5th ACM-IEEE International Symposium on Empirical Software Engineering, ISESE '06, Rio de Janeiro, Brazil, September 2006.
50. Curtis A., Izurieta C., Joeris B.L., Lundberg S., McConnell R.M. “*An Implicit Representation of Chordal Comparability Graphs in Linear Time*”. 32nd International Workshop on Graph-Theoretic Concepts in Computer Science, WG '06, Bergen, Norway, June 2006.
51. Izurieta C. “*Semi Greedy Algorithm for Finding Connectivity in Microchip Physical Layouts*”. 16th International Conference on Computer Applications in Industry and Engineering, CAINE '03, Las Vegas, NV, November 2003.
52. Izurieta C., Nielsen A. “*DMI Technology*”. InterWorks '99 Systems Administration Conference, Chicago, IL, 1999.

Journals

1. Ramac R., et al., Izurieta C. “*Prevalence, Common Causes and Effects of Technical Debt: Results from a Family of Surveys with the IT Industry*,” The Journal of Systems and Software, 2021. <https://doi.org/10.1016/j.jss.2021.111114>
2. Freire S., et al., Izurieta C. “*Pitfalls and Solutions for Technical Debt Management in Agile Software Projects*,” IEEE Software, 2021. doi: 10.1109/MS.2021.3101990
3. Ramac R. et al., Izurieta C., “*Technical and Non-Technical Prioritization Schema for Technical Debt: Voice of TD-Experienced Practitioners*,” IEEE Software, 2021. doi: 10.1109/MS.2021.3103121
4. Nelson G., Izurieta C., “*A Gap in the Analysis of Technical Debt in Procedural Languages: An Experiential Report of Go*,” IEEE Software, 2021. doi: 10.1109/MS.2021.3103710
5. Raile E., Shanahan E., Ready R., McEvoy J., Izurieta C., Reinhold A.M., Poole G., Bergmann N., King H., “*Narrative Risk Communication for Environmental Hazard Preparation*,” Journal of Environmental Communication, August 2021, <https://doi.org/10.1080/17524032.2021.1966818>
6. Perez B., Castellanos C., Correal D., Rios N., Freire S., Spinola R., Seaman S., Izurieta C., “*Technical Debt Payment and Prevention Through the Lenses of Software Architects*,” Information and Software Technology Journal, Vol. 140, Dec. 2021, <https://doi.org/10.1016/j.infsof.2021.106692>
7. Rios N., Freire S., Perez B., Castellanos C., Correal D., Mendonca M., Falessi D., Izurieta C., Seaman C., Spinola R., “*On the Relationship between Technical Debt Management and Process Models*,” IEEE Software, 2021. <https://doi.ieeecomputersociety.org/10.1109/MS.2021.3058652>
8. Shanahan E.A., Reinhold A.M., Raile E.D., Poole G.C., Ready R.C., Izurieta C., McEvoy J., Bergmann N.T., King H.W., “*Characters Matter: How Narratives Shape Affective Responses to Risk Communication*,” PLoS One 14(12): e0225968, <https://doi.org/10.1371/journal.pone.0225968>, December 2019
9. Bergmann N., McEvoy J., Shanahan E., Raile E., Reinhold A.M., Poole G.C., Izurieta C. “*Thinking Through Levees: How Political Agency Extends Beyond the Human Mind*,” Annals of the American Association of Geographers. Online, Oct 14, 2019. <https://doi.org/10.1080/24694452.2019.1655387>
10. Reinhold A.M., Poole, G.C., Izurieta C., Helton A., Bernhardt E. S. “*Constraint-based simulation of multiple interactive elemental cycles in biogeochemical systems*,” Ecological Informatics, Elsevier. Vol.50, pp. 102-121. <https://doi.org/10.1016/j.ecoinf.2018.12.008>, March 2019

11. Assefi M., Liu G., Wittie M.P., Izurieta C., "Measuring the Impact of Network Performance on Cloud-Based Speech Recognition Applications," International Journal of Computer Applications IJCA, Vol 23, Issue 1, March 2016.
12. Payn R.A., Helton A.M., Poole G.C, Izurieta C., Burgin A.J., Bernhardt E.S., "A generalized optimization model of microbially driven aquatic biogeochemistry based on thermodynamic, kinetic, and stoichiometric ecological theory," Ecological Modelling. December 24, 2014.
13. Zazworka N., Vetro A., Izurieta C., Wong S., Cai Y., Seaman C., Shull F., "Comparing Four Approaches for Technical Debt Identification," Springer Software Quality Journal. Vol 2, Issue 3, pp. 403-426. September 2014. doi: 10.1007/s11219-013-9200-8.
14. Della Croce P., Poole G.C., Payn R.A., Izurieta C., "Simulating the Effects of Stream Network Topology on the Spread of Introgressive Hybridization Across Fish Populations." Environmental Modelling & Software. Vol 279, pp. 68-77, <http://dx.doi.org/10.1016/j.ecolmodel.2014.02.014>, May 10 2014.
15. Zazworka N., Vetro A., Izurieta C., Wong S., Cai Y., Seaman C., Shull F., "Comparing four approaches for Technical Debt identification: Analysis on Hadoop Project," **Book Chapter** 3.2, pages 65-84. In Assessing The Impact Of Automatic Static Analysis On Software Quality, by Vetro A., Morisio M., and Torchiano M. Scholar's Press, <http://porto.polito.it/2531301/> ISBN-13: 978-3-639-70516-4, 20 February, 2014.
16. Helton, A.M., G.C. Poole, R.A. Payn, Izurieta C., and J.A. Stanford. "Relative influences of the river channel, floodplain surface, and alluvial aquifer on simulated hydrologic residence time in a montane river floodplain." Elsevier Journal of Geomorphology. Volume 205, pp. 17-16, January 2014. <http://dx.doi.org/10.1016/j.geomorph.2012.01.004>.
17. Mason S.J.K., Cleveland S., Llovet P., Izurieta C., Poole G.C., "A Centralized Tool for Managing, Archiving, and Serving Point-In-Time Data In Ecological Research Laboratories," Elsevier Journal of Environmental Modelling and Software, Volume 51, pp. 59-69, <http://dx.doi.org/10.1016/j.envsoft.2013.09.008>, January 2014.
18. Schuh M., Sheppard J., Strasser S., Angryk R., Izurieta C., "An IEEE standards-based Visualization Tool for Knowledge Discovery in Maintenance Event Sequences," IEEE Aerospace and Electronic Systems Magazine, Vol 28, Issue 7, pp 30-39, July 2013.
19. Izurieta C., Bieman J.M., "A Multiple Case Study of Design Pattern Decay, Grime, and Rot in Evolving Software Systems." Springer Software Quality Journal. June 2013. Vol 21, Issue 2, pp. 289-323. doi: 10.1007/s11219-012-9175-x.
20. Helton A.M., Poole G.C., Payn R.A., Izurieta C., Stanford J. A., "Scaling flow path processes to fluvial landscapes: An integrated field and model assessment of temperature and dissolved oxygen dynamics in a river-floodplain-aquifer system," Journal of Geophysical Research –Biogeosciences, October 2012, Vol.117, G00N14. Doi:10.1029/2012JG002025.
21. Curtis A., Izurieta C., Joeris B.L., Lundberg S., McConnell R.M. "An Implicit Representation of Chordal Comparability Graphs in Linear Time," Journal of Discrete Applied Mathematics 158 (2010) 869-875, Elsevier, January 2010.
22. Izurieta C. "Decay and Grime Buildup in Evolving Object Oriented Design Patterns". PhD. Dissertation, Colorado State University, Fort Collins, Colorado, May 2009. Library of Congress Registration No. TX 6-692-829.
23. Izurieta C. "An Emergent Architecture for Use in Navigational Planning and Environment Learning". Master's thesis and ACM Computer Science Conference Poster presentation, Indianapolis, IN, 1993.

Patents (and applications)

1. Izurieta C. "Scan and Detection Systems and Methods". Defensive Publication US 2005-0204321 A1, US Patent and Trademark Office, September 2005. <https://www.google.com/patents/US20050204321>
2. Izurieta C. "An Object Oriented Mechanism for Reporting Events in Scan Based Traversals of Microchip Physical Layout data". Defensive Publication US 2005- 0125808 A1, US Patent and Trademark Office, September 2005. <https://www.google.com/patents/US20050125808>
3. Izurieta C. "A Method For Linking Non Object Oriented Data Models to Object Oriented Data Models Using A Technique To Achieve Zero-Size Mapping". French Patent (European Union) 0201628, granted

3/11/05. Hewlett-Packard, Ft. Collins, CO, Disclosed 2001.
<https://www.google.com/patents/US20020116700>

Posters

1. Kimball K., Valentien T., Izurieta C. “*Measuring Software Quality: Aggregating from a Security Based Model*,” Research Experiences for Undergraduates Symposium, Alexandria, VA, Oct 22-23 2017.
2. Izurieta C. “*Mechanisms of Software Decay*”. Poster presentation at the Information Science and Technology Research Colloquium, ISTeC 2006, Fort Collins, CO, 2006
3. Izurieta C. “*Finding connectivity in microchip artwork design*”. Poster presentation at the Information Science and Technology Research Colloquium, ISTeC 2005, Fort Collins, CO, 2005
4. Izurieta C. “*Architecture for Use in Navigational Planning and Environment Learning*”. First ACM Computer Science Conference Poster Competition Award, Indianapolis, IN, 1993

Presentations

1. “*Design Pattern Characterization, Detection and Refactoring*,” Software Engineering Institute, Carnegie Mellon University, February 22, 2019.
2. “*On The Technical Debt of Security Weaknesses and Attacks*,” University of Groningen, Groningen, Netherlands, Jan 24, 2019.
3. “*Technical Debt Associated with Security Weaknesses*,” University of Calgary Invited Seminar, Calgary, Canada, March 22 2018.
4. “*Design of an extensible data and workflow management system*,” AFRI FACT Workshop, USDA Agriculture and Food Research Initiative, Los Angeles, CA, USA. Dec 17, 2017.
5. “*NuMo – Interdisciplinary app development in the consumer interest*,” Annual meeting American Council on Consumer Interests. Albuquerque, NM, USA, April 20, 2017.
6. “*K-12 Outreach Through Practical Software R&D in the Software Factory Environment*,” International Conference on Learning, Teaching, and Student Success. November 4, 2016. Bozeman, MT, USA.
7. “*On Technical Debt and Quality Models of Software Systems*,” Dahlgren Naval Surface Warfare Center, Virginia, July 21, 2016.
8. “*Technical Debt Aware Modeling*,” Dagstuhl 16162, Invited Participant, Schloss Dagstuhl, Germany, April 18-22, 2016.
9. “*The interplay between architectural (or model driven) technical debt vs. code (or implementation) technical debt*,” Dagstuhl 16162, Invited Participant, Schloss Dagstuhl, Germany, April 18-22, 2016.
10. “*Modeling and Measuring Technical Debt*,” Workshop, Co-Chairs: Shull F., Izurieta C., 23rd Annual Meeting of the International Software Engineering Research Network, ISERN, October 19-20, 2015, Beijing, China.
11. “*Technical Debt and its Consequences*,” Montana State University College of Engineering Seminar Series, Bozeman, MT, October 2014.
12. “*Software Factories*,” Montana State University Alumni Foundation Event, Portland, OR, March 26th, 2014.
13. “*Challenges in Measuring Technical Debt: Research and Industry Perspectives*,” **Panel**. Moderator: Philippe Kruchten, **Panelists**: Izurieta C., Shull F., Boehm B., 5th International Workshop on Managing Technical Debt MTD. IEEE ACM ESEIW 2013, Baltimore, USA, October 9th, 2013.
14. “*Measurement and Prevention of Technical Debt*,” and “*An Introduction to Montana State University*,” Universidad Catolica de la Santisima Concepcion, Concepcion, Chile, June 25, 2013.
15. “*Methods to Reduce the Technical Debt of Ecosystem Informatics*,” Universidad de Concepcion, Concepcion, Chile, May 16, 2013.
16. “*Reducing the Technical Debt of Ecosystem Informatics*,” Montana State University, Institute on Ecosystems, Bozeman, MT, March 2013.
17. “*Reducing the Technical Debt of Ecosystem Informatics*,” University of Montana, Institute on Ecosystems, Missoula, MT, March 2013.
18. “*An Introduction to the Observer Pattern and Design Concepts*,” Carroll College of Montana, Helena, MT, October 2012.

19. *"Design Patterns,"* University of Wisconsin, Eau-Claire, Eau-Claire, WI, March 2011.
20. *"Mutualism and the Co-Evolution of Ecological and Software Engineering models,"* Montana State University, Bozeman, MT. February 2011.
21. *"Decay, Rot and Grime in Evolving Object Oriented Design Patterns."* Eastern Oregon University, La Grande, OR, May 2010.
22. *"Modeling Ecosystems with Network Exchange Objects."* Rocky Mountain Supercomputing Center Application Day 2010, Butte, MT, March 2010.
23. *"Software Engineering using the UML."* RightNow Technologies, Bozeman, MT, December 2009.
24. *"Mature Products and Platforms Design and Testing."* Zoot Technologies, Bozeman, MT, November 2009.
25. *"Decay and Grime Buildup in Evolving OO Design Patterns."* Montana State University, Bozeman, MT, September 2009.
26. *"Software Decay and Grime Buildup in Evolving OO Design Patterns"*. University of Wisconsin La Crosse, La Crosse, Wisconsin, March 2009.
27. *"Software Decay and Grime."* Montana State University, Invited Seminar Talk, Bozeman, MT, October 2007.
28. *"Interviewing and Researching Employers."* Montana State University, Employer Workshop for students, Three Forks, MT, February 2007.
29. *"Resume writing and Networking with Employers."* Montana State University, Employer Workshop for students, Three Forks, MT, February 2006.
30. *"Applying the Flipper Technology to System Management Tasks."* Hewlett-Packard, Ft. Collins, CO, 1997.
31. *"Flipper: A Model Based Reasoning Approach To Systems Management."* Montana State University, Bozeman, MT, 1996.
32. *"Life of a Software Engineer."* Montana State University, Bozeman, MT, 1995.
33. *"Distributed Computing Environment Configuration."* US West customer visit to Hewlett-Packard, Ft. Collins, CO, 1993.
34. *"Dynamic Path Planning In Sensor Based Terrain Acquisition."* Montana State University, Bozeman, MT, 1992.
35. *"Outstars In Neural Networks."* Montana State University, Bozeman, MT, 1991.

White Papers and Reports

1. Reimanis D., Izurieta C., *"Initial Capabilities Analysis of Existing and Available Software QA Analysis Tools and Models,"* Department of Homeland Security Science and Technology, March 13, 2021
2. Reimanis D., Izurieta C., *"Case Studies to Assess Developed QA Models,"* Department of Homeland Security Science and Technology, March 13, 2021
3. Reimanis D., Izurieta C., *"Initial Gap Analysis of Existing and Available Software QA Analysis Tools and Models,"* Department of Homeland Security Science and Technology, March 13, 2021
4. Bergmann N., Izurieta C., McEvoy J., Poole G.C., Raile E., Ready R., Reinhold A.M., Shanahan E., *"Narrative Risk Communication: A Lingua Franca for Hazard Preparation?"* Evidence in Governance and Politics, EGAP, ID: 20190729AA. <http://egap.org>, July 2019.
5. Carver J., Prikładnicki R., (Collaboration Izurieta C.), *"Industry-Academia Collaboration in Software Engineering,"* IEEE Software Magazine, Vol 35, No 5, pp. 120-124 September-October 2018.
6. *"Can optimization associated with on-farm experimentation using site-specific technologies improve producer management decisions?,"* 14th International Conference on Precision Agriculture, Montreal, Canada, June 24-27 2018.
7. Raile E., King H., Shanahan E., McEvoy J, Izurieta C., Bergmann N., Ready R., Reinhold A.M., Poole G., *"Narrative-based Risk Communication: A Lingua Franca for Natural Hazard Messages?,"* 76th Annual Midwest Political Science Association, Chicago IL, April 5-8, 2018.
8. Fontana F., Trumler W., Avgeriou P., Chatzigeorgiou A., Izurieta C., Nord R., *"Technical Debt in Agile Development,"* 9th Workshop on Managing Technical Debt (MTD 2017), Cologne, Germany, May 22, 2017. ACM SigSoft Software Engineering Notes.

9. Fontana F., Trumler W., Izurieta C., Nord R., "Proceedings Report on the MTD 2017 Workshop," 9th Workshop on Managing Technical Debt (MTD 2017), Cologne, Germany, May 22, 2017.
10. Izurieta C., Ozkaya I., Seaman C., and Snipes W. "Technical Debt: A Research Roadmap," Report on the 8th Workshop on Managing Technical Debt (MTD 2016), ACM SIGSOFT Software Engineering Notes. Volume 42, Issue 1, pp. 28-31, March 2017.
11. Izurieta C. "Integrating Into Enterprise System Management Platforms". Hewlett-Packard, Ft. Collins, CO, 1996
12. Izurieta C. "The Flipper Compiler". Hewlett-Packard, Ft. Collins, CO, 1996
13. Izurieta C. "Integration of NIS+ And SAM". Hewlett-Packard, Ft. Collins, CO, 1995
14. Izurieta C. "DCE Cell Renaming And Hierarchical Cells". Hewlett-Packard, Ft. Collins, CO, 1994

Abstracts

1. Payn R., Mohr E., Isaksen-Swensen E., Schlotfeldt T., Poole G., Reinhold A.M., DeGrandpre M., Blazczak J., Hall R., Izurieta C., Valett M., "Developing Extensible Software to Infer Ecosystem Metabolic Rates in Streams from Multivariate Metabolite Signals," Society for Freshwater Science Annual meeting, Salt Lake City, UT, May 12-23, 2019.
2. McEvoy J., Shannahan E., Raile E., Izurieta C., Reinhold AM., Bergmann N., Poole G., Ready R., King H., "How Views of Dubious Science Affect Public Perception of Floodplain Management along the Yellowstone River, Montana, USA," American Association of Geographers, AGG '19, Washington, DC, April 2019.
3. Maxwell B., Bekkerman A., Silverman N., Payn R., Sheppard J., Izurieta C., Davis P., "Can optimization associated with on-farm experimentation using site-specific technologies improve producer management decisions?," 14th International Conference on Precision Agriculture ICPA, June 24-27 2018, Montreal, Canada.
4. Payn R., Maxwell B., Izurieta C., Sheppard J., "On-farm experimentation in precision agriculture: developing big data technology to improve the odds of agronomic profits in Montana". 2017 Malt Barley and Sugarbeet Symposium. Great Falls, MT, January 11 2017.
5. Reinhold A.M., Poole G.C., Helton A.M., Izurieta C., Payn, R.A., Bernhardt E.S., "A constraint-based, compound specific approach to modeling linked biogeochemical cycles," SFS, Sacramento, CA, May 21-26, 2016.
6. Reinhold A.M., Poole G.C., Helton A.M., Payn R.A., Izurieta C., Bernhardt E.S., Burgin A.J., "Simulating concurrent metabolic pathways in biogeochemical systems," Society of Freshwater Science Meeting, SFS, Milwaukee, WI, May 17-22, 2015.
7. Reinhold A.M., Poole G.C., Payn R.A., Izurieta C., "Limits of transient storage assumptions for heat: Using residence time distribution to estimate mean temperature of hyporheic discharge in montane alluvial streams," Society of Freshwater Science Meeting, SFS, Milwaukee, WI, May 17-22, 2015.
8. Payn R.A., Izurieta C., Poole G.C., "An exploration of convergent evolution in academia: Why ecosystem ecologists and biochemists should think about the tools of software engineering," Society of Freshwater Science Meeting, SFS, Milwaukee, WI, May 17-22, 2015.
9. Helton A., Poole G.C., Payn R., Izurieta C., Stanford J., Bernhardt E., "Scaling Hydrologic and Biogeochemical Processes in a Large River Floodplain and Alluvial Aquifer," 2014 AGU Fall Meeting, San Francisco, USA, December 15-19 2014.
10. Poole G.C., Helton A., Izurieta C., Payn R., Stanford J., Bernhardt E., Burgin A. "Simulating the Hydro-Ecology of a Large River Floodplain and Alluvial Aquifer: Progress and Future Directions," 2014 JASM, Joint Aquatic Sciences Meeting, May 18-13, Portland, USA.
11. Poole G.C., Helton A., Izurieta C., Payn R., Stanford J., Bernhardt E., Burgin A. "Progress and Future Directions in Simulating Ground- and Surface-Water Exchange and Biotic Solute Processing in a Large River Alluvial Aquifer," 2014 EGU General Assembly, Vol 16, April 22 - May 2 2014, Vienna, Austria.
12. Payn R.A., A.M. Helton, G.C. Poole, C. Izurieta, E.S. Bernhardt, A.J. Burgin, "A Generalized Model of Aquatic Microbial Metabolism Based on Thermodynamic, Kinetic, and Stoichiometric Theory," SFS Society for Freshwater Science, Annual Meeting 2013, Jacksonville Florida, May 19-23, 2013.
13. Payn R.A., A.M. Helton, G.C. Poole, C. Izurieta, E.S. Bernhardt, A.J. Burgin, "Exploring the controls of soil biogeochemistry in a restored coastal wetland using object-oriented computer simulations of uptake

- kinetics and thermodynamic optimization in batch reactors,"* 2012 AGU Fall Meeting, San Francisco, USA, December 3-7 2012.
14. Poole G.C., Helton A.M., Izurieta C., Payn R.A., Bernhardt E.S., Burgin A.J., Griffith I., Nix R., Ardon M., Stanford J.A., "Modeling Functional Heterogeneity of Multiple Interactive Ecological Currencies in Linked Channel, Floodplain, and Aquifer Systems," SFS 2012 Annual Meeting, Freshwater Stewardship: Challenges and Solutions. Louisville, KY, May 20-24, 2012.
 15. Mason S.J.K., Cleveland S.B., Llovet P., Izurieta C., Poole G.C., "The Virtual Observatory and Ecological Informatics System (VOEIS): Using RESTful Architecture and an Extensible Data Model to Provide a Unique Data Management Solution," 2012 Spring Runoff Conference, Utah State University, Logan Utah, USA, April 3-4 2012. [Abstract](#).
 16. Helton A.M., Poole G.C., Bernhardt E.S., Payn R.A., Izurieta C., Burgin A.J., "Simulating the Influence of Saltwater Intrusion on Coupled Element Cycles in Coastal Plain Wetlands" 9th Intecol International Wetlands Conference, Society of Wetland Scientists SWS 2012, Orlando, Florida, June 3-8, 2012.
 17. Llovet P., Izurieta C., Cleveland S., "The VOEIS HIS Gateway: A REST Interface for a HydroServer using ODM 1.1" 2011 CUAHSI Conference on Hydrologic Data and Information Systems, Logan Utah, USA, June 22-24 2011.
 18. Izurieta C., Poole G.C., McGlynn B.L., Cross W.F., Marshall L.A., Jacobs G.A., Cleveland S., Judson I., Hauer F.R., Kucera B., "A Cyber-Infrastructure for a Virtual Observatory and Ecological Informatics System -- VOEIS" 2010 AGU Fall Meeting, San Francisco, USA, December 13-17 2010.
 19. Poole G.C., Izurieta C., Payne R.A., Helton A.M., Bernhardt E.S., Wright M.S., Burgin A.J., Stanford J.A. "System-Level Hypothesis Testing: A Novel Approach to Developing Parsimonious Models of Complex Ecosystem Dynamics." 2010 Summer Meeting, Joint Meeting with ASLO, NABS, Aquatic Sciences: Global Changes from the Center to the Edge, Santa Fe, New Mexico, USA, June 6-11 2010.

Grant Support (Current and Past)

- PI. "Fault Tolerant Computing Based on Reconfigurable Hardware/Software Architectures," Resilient Computing, LLC, \$35,000, July 2021 – December 2022.
- Co-PI. "VICEROY Northwest Virtual Institute for Cybersecurity Education & Research (CySER)," Griffiss Institute, Department of Defense, \$162,000, July 2021 – June 2023.
- PI. "Cyber QR Ops: Improving the Quality and Resiliency of Critical Computing Infrastructure," Department of Homeland Security Science and Technology, in collaboration with Idaho National Laboratories, \$3,100,000, September 2020, August 2023.
- Co-PI. "Improving Cyber Survivability with Real Time Hardware Diversification," Raytheon Systems Company, \$300,000, June 2020 – June 2023.
- PI. "REU Site: Research Experiences in Cybersecurity Algorithms," NSF, US\$405,000. June 2020 - August 2022.
- Co-PI. "Initiating a Cybersecurity Research Program within the NACOE," Montana State University, \$25,000, March 2019 – March 2020.
- PI. "What To Fix? Refactoring Assistant Project," Carnegie Mellon University and Department of the Air Force, \$5,000, January 2019 - April 2020.
- PI. "Electromagnetic Spectrum (EMS) Situational Awareness (SA) & Command and Control (C2) with Wideband Sensors & Data Analytics," S2 Corporation, Gift US\$75,000. August 2018 – Expiration.
- PI. "REU Site: Research and Development of Algorithms in a Software Factory," NSF, US\$288,000. June 2017 - June 2019.
- Co-PI. "The Impacts of Narratives-based Risk Communication on Hazard Preparedness," NSF, US\$550,000 (Izurieta \$113,315), September 2016 – August 2020.
- DoD, DLA, Air Force Patterson, US Army Corps of Engineers Research and Development Center, Construction Engineering Research Laboratories (CERL)
 - * PI. "Hierarchical Quality Analysis and Testing of Sustainment Management Systems," US\$200,000, June 2021 – May 2022.

- PI. *"Hierarchical Quality Analysis and Testing of Sustainment Management Systems,"* US\$330,000, September 2020 – August 2022.
- PI. *"Software Quality Analysis of Army Construction Engineering Laboratory's Sustainment Management Systems,"* US\$201,243, July 2020 – June 2021.
- PI. *"Software Quality Analysis of Army Construction Engineering Laboratory's (CERL) BUILDER Sustainment Management Systems,"* US\$200,000, April 2019 – June 2020.
- PI. *"AF 2 Software Quality Analysis of Army Construction Engineering Laboratory's (CERL) BUILDER Sustainment Management Systems,"* US\$200,000, April 2018 – June 2019.
- PI. *"Software Quality Analysis of Army Construction Engineering Laboratory's (CERL) FUELER Sustainment Management Systems,"* US\$208,421, April 2018 – June 2019.
- PI. *"Quality Assurance of Lifecycle Management Decision Support Systems,"* US\$100,000, August 2017 – March 2018.
- PI. *"Quality Assurance of Lifecycle Management Decision Support Systems,"* US\$200,000, March 2017 – January 2018.
- PI. *"Quality Assurance of Lifecycle Management Decision Support Systems,"* US\$75,000, September 2016 – March 2017.
- PI. *"Sustainability Management Systems Research and Development,"* US\$146,242, October 2015 – December 2016.
- PI. *"Sustainability Management Systems Research and Development,"* US\$150,000, October 2014 – September 2015.
- Co-PI. *"Increasing Profitability by Improving Efficiency of Montana's Farm and Ranch Lands,"* US\$2,276,734 (Izurietta \$190,000), Montana Research Initiative, State of Montana, August 2015 – June 2017.
- PI. *"Software Quality Assurance in Financial Solutions,"* Zoot Enterprises, US\$134,763, January 2015 – December 2018.
- PI. Faculty Excellence Award. US\$3600, Montana State University 2015.
- PI. *"Software Factory Initiation,"* Zoot Enterprises, US\$9000, October 2014.
- Institute on Ecosystems, Montana University System
 - Co-PI. *"Focus 2: A general solution to optimization-based modeling of microbial biogeochemistry: an algorithm to generate user specified models,"* Institute on Ecosystems, Montana State University, US\$37,185, September 2015 – August 2016.
 - Co-PI. *"Focus 2: Development and Application of a Simulation Framework,"* Institute on Ecosystems, Montana State University, US\$47,856, October 2013 – August 2014.
 - Co-PI. *"Focus 2: Development and Application of a Simulation Framework for Quantifying Uncertainty Across Competing Models of System Complexity,"* Institute on Ecosystems, Montana State University, US\$93,862, November 2012 - August 2013.
 - Co-PI. *"Graduate Fellowships Year One,"* Institute on Ecosystems, Montana State University, US\$15,000, August 2012 - May 2013.
 - Co-PI. *"Projecting climate change in Pacific Rim rivers: Landscape scale influences on salmonid vulnerability using satellite remote sensing and genomics,"* Institute on Ecosystems incubation grant, Montana University System, US\$8,000, March - August 2012.
 - Co-PI. *"Seasonality and sources of recharge water to the Nyack floodplain in relation to rates of biogeochemical processes and ecosystem function,"* Institute on Ecosystems incubation grant, Montana University System, US\$29,500, March - August 2012.
- Co-PI. *"REU Site: Research in Networking and Networks with Applications to Sustainability,"* NSF, US\$359,640. June 2012.
- PI. *"VOEIS -- A Virtual Observatory for Ecological Informatics System,"* MT NSF EPSCoR, US\$570,000 September 2011. Awarded (Year 3). Collaborative proposal with University of Montana and University of Kentucky. Overall funding \$5M.
- Co-PI. *"Collaborative Research: Coupled C, N and S cycling in coastal plain wetlands: how will climate change and salt water intrusion alter ecosystem dynamics,"* NSF. US\$424,951. September 2010.

Awarded. Collaborative proposal with Duke University and Wright State University. Overall funding \$1.2M.

- Co-PI. “*Vehicle Level Reasoning System*,” The Boeing Company/NASA Ames Research Center, Aviation Safety Program Office(ARMD NRA NNH09ZEA001N-IVHM1). US\$59,175. Summer 2009.
- Co-PI. “*Measurement and Simulation of Ecosystem Dynamics Across Stream Networks: An Interdisciplinary Multi-scale Approach*,” A proposal to address interdisciplinary research priorities outlined in the NSF’s letter to colleagues entitled Multi-scale Modeling (MSM, NSF 09-032) and Emerging Topics in Biogeochemical Cycles (ETBC, NSF 09-030). US\$7495. Summer 2009. Awarded
- PI. “*Equipment grant for the IT department at Montana State University*,” Hewlett Packard Co., US\$42000. Fall Semester 2008.
- PI. “*Small Grant General Fund for the Association and Computing Machinery (ACM) at Colorado State University*,” Intel Corporation, US\$2000. Fall Semester 2007.

Senior Staff

- Software Architect. “*Cyberinfrastructure for a Virtual Observatory and Ecological Informatics System (VOEIS)*,” F. Richard Hauer (PI). (MT NSF EPSCoR Grant: M66012/66013 American Recovery and Reinvestment Act. August 2008 – July 2011.

Conferences Service

- Software Engineering (ESEM, ISESE, CibSE, ASE, ICGSE, ICSR, SANER, MALETS, ICSoft)
 - ESEM (International Conference on Empirical Software Engineering and Measurement)
 - Co General Chair: 2022 (USA)
 - PC Member: 2021 (Italy), 2018 (Finland), 2017 (Canada), 2014 (Italy)
 - Session Chair: 2015 (China), 2010 (Italy)
 - Publicity Chair: 2016 (Spain)
 - Short Research Papers General Chair: 2013 (USA)
 - Presenter: 2007 (Spain)
 - ISESE (International Symposium on Empirical Software Engineering)
 - Presenter: 2006 (Brazil)
 - CibSE (Congreso Iberoamericano en Ingeniería de Software)
 - PC Member: 2021 (Costa Rica), 2020 (Brazil), 2019 (Cuba), 2018 (Colombia), 2017 (Argentina), 2016 (Ecuador)
 - ASE (International Conference on Automated Software Engineering)
 - PC Member: 2016 (Singapore)
 - ICGSE (International Conference on Global Software Engineering)
 - PC Member: 2014 (China)
 - ICSR (International Conference on Software and Systems Reuse)
 - Industry General Chair: 2019 (USA)
 - SANER
 - PC Member: 2020 (Canada), Proceedings Chair: 2021 (USA)
 - MALETS (International Workshop on Machine Learning Technologies in Software Engineering)
 - Presenter: 2011 (USA)
 - ICSoft (International Conference on Software Technologies)
 - PC Member: 2021 (on-line)
- Architectural Quality and Technical Debt (TechDebt, MTD, TDA, QoSA, Dagstuhl)
 - TechDebt (International Conference on Technical Debt)
 - PC Member: 2021 (Spain-online), 2019 (Canada),
 - General Chair: 2020 (Korea-online)
 - Tools Track Chair: 2019 (Sweden)

- MTD (International Workshop on Managing Technical Debt)
 - Chair, PC Member: 2017 (Germany), 2016 (USA), 2015 (Germany), 2014 (Canada), 2013 (Switzerland)
- TDA (International Conference on Technical Debt Analytics)
 - Session Chair, Panelist: 2016 (New Zealand)
- QoSA (International Conference on the Quality of Software Architectures)
 - PC Member: 2015 (Canada)
- Dagstuhl (International Work series Dagstuhl on Managing Technical Debt)
 - Participant: 2016 (Germany)

- Cybersecurity (CSR, CReSCT)
 - CSR (International Conference on Cybersecurity and Resilience)
 - PC Member: 2021 (on-line)
 - CReSCT (Cyber Resilient Supply Chain Technologies)
 - PC Member: 2020 (on-line)

- General Computer Science (EuroMicro-SEAA, SOFSEM, WSESE, IEEE Congress, SIGCSE)
 - EuroMicro (Software Engineering and Advanced Applications)
 - PC Member: 2021 (Italy), 2019 (Greece), 2017 (Austria)
 - SOFSEM (International Conference on Current Trends in Theory and Practice of Computer Science)
 - PC Member: 2021 (Italy), 2020 (Cyprus)
 - WSESE (Methodological Issues with Empirical Studies involving Human Subjects)
 - PC Member: 2018 (Netherlands)
 - IEEE Services Congress
 - PC Member: 2017 (USA)
 - SIGCSE (Computer Science Education)
 - PC Member: 2017 (USA), 2016 (USA)

- Journals (Active Reviewer)
 - Elsevier Information and Software Technology Special Issue “Value and Waste in Software Engineering,” **Guest Editor**.
 - ACM Transactions on Reliability <http://mc.manuscriptcentral.com/tr-ieee>
 - ACM Transactions on Software Engineering <http://mc.manuscriptcentral.com/tse-cs>
 - Software Quality Journal <http://link.springer.com/journal/11219>
 - The Journal of Object Technology <http://www.jot.fm>
 - Elsevier’s Information and Software Technology Journal
<http://www.journals.elsevier.com/information-and-software-technology>
 - Guest Editor, special issue on Value and Waste in Software Engineering, 2021
 - Information Sciences Journal <http://www.journals.elsevier.com/information-sciences>
 - Journal of Software Evolution and Process
[http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)2047-7481](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)2047-7481)
 - Journal of Systems and Software <http://www.journals.elsevier.com/journal-of-systems-and-software/>
 - Empirical Software Engineering Journal <http://link.springer.com/journal/10664>
 - IEEE Access Journal <http://ieeaccess.ieee.org>
 - IEEE Software Magazine
 - IEEE Transactions on Software Engineering

Classes Taught

- Programming with Java (CSCI 111) 2015 – Present.
- Programming with C (CSCI 112) 2015-Present.
- Undergraduate Research (CSCI 482R, CSCI 483R) 2009-Present.
- Software Engineering I (ESOF 322) 2008-Present.

- Lifecycles, design patterns, UML, architecture, prescriptive and agile techniques.
- Software Engineering II (ESOF 422) 2009-Present
 - Formal methods, testing theory
- Empirical Software Engineering (ESOF 522) 2013-Present
 - Scientific methods, experimentation, case studies, validity threats, empirical methods, data analysis, GQM, measurement theory.

Honors and Awards

- Montana State University College of Engineering Lloyd Berg award, April 2020
- Montana State University Gianforte School of Computing “2018 Professor of the Year Award,” Selected by Students. Bozeman, MT, April 2018
- Montana State University and Bozeman Chamber of Commerce Faculty/Staff 2018 Award of Excellence. 36th Annual Awards for Excellence 2018. Mentee: Cortney Linder.
- Montana State University College of Engineering “2017 Teacher of the Year Award,” Bozeman, MT, 2017.
- Montana State University and Bozeman Chamber of Commerce Faculty/Staff 2017 Award of Excellence. 35th Annual Awards for Excellence 2017. Mentee: Mackenzie O’Bleness.
- Montana State University “Provost’s Award for Undergraduate Research and Creativity Mentoring,” Bozeman, MT, 2017.
- Assefi M., Liu G., Izurieta C., Wittie M.P., "An Experimental Evaluation of Apple Siri and Google Speech Recognition," 24th International Conference on Software Engineering and Data Engineering, SEDE 2015, San Diego, California, October 12-14, 2015. **Best Conference Paper Runner Up Award.**
- Montana State University Department of Computer Science “2015 Service and Outreach Award,” Bozeman, MT, 2015.
- Montana State University Department of Computer Science “2013 Researcher of the Year Award,” Bozeman, MT, 2013.
- Montana State University and Bozeman Chamber of Commerce Faculty/Staff 2013 Award of Excellence. 31st Annual Awards for Excellence 2013. Mentee: Rachel Luhr.
- Schuh M., Sheppard J., Strasser S., Angryk R., Izurieta C. "Ontology-Guided Knowledge Discovery of Event Sequences in Maintenance Data." IEEE AutoTestCon Conference 2011, Baltimore, Maryland, USA, September 12-15, 2011. **Best Conference Student Paper Award.**
- Montana State University Department of Computer Science “2010 Professor of the Year Award,” Selected by Students. Bozeman, MT, April 2010
- Upsilon Pi Epsilon Honor Society, 2009
- Intel Digital Group Award for Exemplary Performance in Development of a Circuit Recognition Tool, Ft. Collins, CO, 2006
- HP Unix Development Laboratories “Drive the Future Award” for creative engineering. Ft. Collins, CO, 1996, 1998
- Achievement Award, Student Poster Competition. ACM Computer Science Conference. Indianapolis, IN, 1993
- Honorable mention and award of distinction at the “WestPac Australian Mathematics Competition.” Sydney, Australia, 1983

Graduate Students (Graduated and Current)

- Travis Schanz, MS Computer Science
 - Graduated 2011. Thesis: A Taxonomy of Modular Grime in Design Patterns
- Melissa Dale, MS Computer Science
 - Graduated 2014. Thesis: Impacts of Modular Grime on Technical Debt
- Isaac Griffith, MS Computer Science

- Graduated 2014. Thesis: Technical Debt Management in Release Planning –A Decision Support Framework
- Rachael Luhr, MS Computer Science
 - Graduated 2015. Thesis: The Application of Technical Debt Mitigation Techniques to a Multidisciplinary Software Project
- Killian Smith, MS Computer Science
 - Graduated 2018. Thesis: Exploratory Study on the Effectiveness of Type Level Complexity Metrics
- Derek Reimans, PhD Computer Science
 - Graduated 2019. Thesis: The Identification, Characterization, and Evaluation of Model-Based Behavioral Decay in Design Patterns
- Henry King, MS Computer Science
 - Graduated 2019. Thesis: Informing the Construction of Narrative-Based Risk Communication
- David Rice, MS Computer Science
 - Graduated 2020. Thesis: An Extensible, Hierarchical Architecture for Analysis of Software Quality Assurance
- Shamim Hafiz, MS Computer Science. Graduated 2014, courses option.
- Ryan Nix, MS Computer Science. Graduated 2015, courses option.
- Agata Gruza, MS Computer Science. Graduated 2015, courses option.
- Nathan Fromelt, MS Computer Science. Graduated 2017, courses option.
- Isaac Griffith, PhD Computer Science. Current.
- Nathan Woods, PhD Computer Science. Current.
- Grant Nelson, PhD Computer Science. Current.
- Karishma Rahman, PhD Computer Science. Current.
- Faqeer Rehman, PhD Computer Science. Current.
- Xuying Swift, PhD Computer Science. Current.
- Gerard Shu Fuhnwi, PhD Computer Science. Current.
- Andrew Fallin, PhD Computer Science. Current.
- Andrew Johnson, MS Computer Science. Current.
- Payton Harrison, MS Computer Science. Current.
- Reese Pearsall, MS Computer Science. Current.

Undergraduate Student Research

- Rory Myer, “*Improvements to Programmable Logic Controller Security,*” August 2021 – Present.
- Blake Stanger, Walker Ward, “*Improving Cyber Survivability with Real Time Hardware Diversification,*” Raytheon Systems, July 2020 – Present.
- Marie Morin, “*A Longitudinal Study of Technical Debt in Gaming Systems,*” Undergraduate Scholars Program award recipient (\$1800) Academic year 2017-2018.
- Xuying Wang, “*Prospective Computer Science Student Outreach Trough a Practical Software Development Project in the Software Factory Environment,*” Undergraduate Scholars Program award recipient (\$1800) Academic Summer 2016.
- Ryan Darnell, “*Prospective Computer Science Student Outreach Trough a Practical Software Development Project in the Software Factory Environment,*” Undergraduate Scholars Program award recipient (\$1800) Academic Summer 2016.
- MacKenzie O’Bleness, “*Prospective Computer Science Student Outreach Trough a Practical Software Development Project in the Software Factory Environment,*” Undergraduate Scholars Program award recipient (\$1800) Academic Summer 2015.
- Mike Trenk, “*Prospective Computer Science Student Outreach Trough a Practical Software Development Project in the Software Factory Environment,*” Undergraduate Scholars Program award recipient (\$1800) Academic Summer 2015.

- Rachel Luhr, “*Visualizing Structural and Behavioral Change in Software Systems*,” Undergraduate Scholars Program award recipient. (\$1500) Academic Year 2012-2013.
- Derek Reimanis, “*Developing the Input/Output Module of a Multi-Disciplinary System Modeling Framework*.” Undergraduate Scholars Program award recipient. (\$1500) Fall 2012.
- Renee Cross, Derek Reimanis, Rachel Luhr, “*Using Planetarium Software for Data Visualization of the Natural and Physical Sciences*.” EPSCoR (\$7200), Summer 2012.
- Michael Poulson, “*Particle Tracking Software for Ecosystems Modeling*.” Undergraduate Scholars Program award recipient (\$1500) Summer 2010
- Isaac Griffith, “*Ecosystems Modeling*.” Undergraduate Scholars Program award recipient. (\$1500) Summer 2010

Activities/Memberships

- Director of the Montana State University Software Factory. In collaboration with Zoot Technologies. 2014 – Present.
 - * <http://bobcatsoftwarefactory.com>
- Director of the Software Engineering Laboratory SEL. 2011 – Present.
 - * International Software Engineering Research Network (ISERN) member since 2015
- Created the Computational Ecology Research Group. A collaborative effort with the Land Resources and Environmental Sciences department. 2009 – 2015.
- Member ACM, IEEE Senior Member, AGU (American Geophysical Union)
- Member of the Numerical Intelligent Systems Laboratory (NISL), a collaborative laboratory between Montana State University and Johns Hopkins University. 2009 – Present.
<http://www.cs.montana.edu/sheppard/NISL/index.html>
- Member of the Computer Science Advisory Board at Montana State University. 2007 – 2009.
- Member of the Electrical and Computer Engineering Advisory Board at Montana State University. 2002 – 2007.
- Member of the Montana State University Employer Relations Advisory Board. 2005 – 2009.
- Recruiter and Campus Manager for Intel Corporation at Montana State University. 2004 – 2007.
- Recruiter and Campus Manager for Hewlett-Packard at Montana State University. 1994 – 2009.
- Member of the Association for Computing Machinery.
- Volunteer. Greater Gallatin Watershed Coalition, Gallatin Valley Land Trust. 2008 – 2011.

References

Dr. James Bieman
 Colorado State University
 Department of Computer Science
bieman@cs.colostate.edu
 (970)491-7096

Dr. Geoffrey Poole
 Montana State University
 Land Resources and Environmental Sciences
gpoole@montana.edu
 (406) 994-5564

Dr. John Paxton
 Montana State University
 Department of Computer Science
paxton@cs.montana.edu
 (406) 994-4780