Kenneth Weiss

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Education

Ph.D., Computer Science, University of Maryland, College Park, Spring 2011.

Thesis title: Diamond-based models for scientific visualization.

Advisor: Leila De Floriani

B.S., Computer Science, Binghamton University, 2004

B.A., Mathematics, Binghamton University, 2004

Honors: Summa Cum Laude

Research and Professional Experience

Lawrence Livermore National Laboratory – Livermore, CA

Group Leader, Applications, Simulations and Quality (ASQ), July 2020 – PRESENT.

Numerics, Modular Applications & Performance (NuMAP) group

Computer scientist, Applications, Simulations and Quality (ASQ), January 2014 – PRESENT.

Marbl project, Spring 2015 – PRESENT (CS Lead, Spring 2017 – PRESENT).

Axom computer science toolkit, Spring 2015 – PRESENT (Deputy lead, 2018 – PRESENT).

Kull project, January 2014 – June 2015.

Postdoctoral researcher, Center for Applied Scientific Computing (CASC), January 2012 – January 2014.

Project: Distributed and multiresolution streaming analysis of petascale data.

Mentor: Dr. Peter Lindstrom

Summer Scholar, Institute for Scientific Computing Research (ISCR), Summer 2006.

University of Maryland, College Park – College Park, MD

Faculty Research Associate, Summer 2011 – December 2011.

Graduate Research Assistant, Fall 2006 – Spring 2011.

Project: A multiresolution approach to modeling and visualizing multidimensional scalar fields.

Advisor: Prof. Leila De Floriani

Università di Genova – Genova, Italy

Visiting Scholar, Geometry and Graphics Group, Summers 2007, 2009, 2011 and 2013.

Binghamton University – Vestal, NY

Research Assistant, Graphics And Image Computing Laboratory, Summer 2003 – Spring 2004.

Project: Automating tumor detection in CT images.

Undergraduate advisor: Prof. Lijun Yin.

Publications

Refereed Journal Articles

1. H. Abu-Shawareb et al. Achievement of target gain larger than unity in an inertial fusion experiment. *Physical Review Letters*, 132(6):065102, Feb. 2024.
2. T. Stitt, K. Belcher, A. Campos, T. Kolev, P. Mocz, R. N. Rieben, A. Skinner, V. Tomov, A. Vargas, and K. Weiss. Performance portable Graphics Processing Unit acceleration of a high-order finite element multiphysics application. *Journal of Fluids Engineering*, 146(4):041102, 02 2024.
3. H. Abu-Shawareb et al. Lawson criterion for ignition exceeded in an inertial fusion experiment. *Physical Review Letters*, 129(7):075001, August 2022.
4. A. Vargas, T. M. Stitt, K. Weiss, V. Z. Tomov, J.-S. Camier, T. Kolev, and R. N. Rieben. Matrix-free approaches for GPU acceleration of a high-order finite element hydrodynamics application using MFEM, Umpire, and RAJA. *The International Journal of High Performance Computing Applications*, 36(4):492–509, May 2022.
5. D. Gunderman, K. Weiss, and J. A. Evans. High-accuracy mesh-free quadrature for trimmed parametric surfaces and volumes. *Computer-Aided Design*, 141:103093, December 2021.
6. A. Abdelfattah, V. Barra, N. Beams, R. Bleile, J. Brown, J.-S. Camier, R. Carson, N. Chalmers, V. Dobrev, Y. Dudouit, P. Fischer, A. Karakus, S. Kerkemeier, T. Kolev, Y.-H. Lan, E. Merzari, M. Min, M. Phillips, T. Rathnayake, R. Rieben, T. Stitt, A. Tomboulides, S. Tomov, V. Tomov, A. Vargas, T. Warburton, and K. Weiss. GPU algorithms for Efficient Exascale Discretizations. *Parallel Computing*, 108:102841, December 2021.
7. R. Fellegara, K. Weiss, and L. De Floriani. The Stellar decomposition: A compact representation for simplicial complexes and beyond. *Computers & Graphics*, 98:322–343, August 2021.
8. D. Gunderman, K. Weiss, and J. A. Evans. Spectral mesh-free quadrature for planar regions bounded by rational parametric curves. *Computer-Aided Design*, 130:102944, January 2021.
9. R. Fellegara, L. De Floriani, P. Magillo, and K. Weiss. Tetrahedral trees: A family of hierarchical spatial indexes for tetrahedral meshes. *ACM Transactions on Spatial Algorithms and Systems*, 6(4):23:1–23:34, June 2020.
10. K. Weiss and P. Lindstrom. Adaptive multilinear tensor product wavelets. *IEEE Transactions on Visualization and Computer Graphics (Proceedings IEEE Visualization 2015)*, 22(1):985–994, Jan. 2016.
11. K. Weiss, F. Iuricich, R. Fellegara, and L. De Floriani. A primal/dual representation for discrete Morse complexes on tetrahedral meshes. *Computer Graphics Forum (Proceedings Eurovis 2013)*, 32(3):361–370, 2013.
12. K. Weiss and L. De Floriani. Modeling multiresolution 3D scalar fields through Regular Simplex Bisection. In H. Hagen, editor, *Scientific Visualization: Interactions, Features, Metaphors*, volume 2 of *Dagstuhl Follow-Ups*, pages 360–377. Schloss Dagstuhl–Leibniz-Zentrum für Informatik, Dagstuhl, Germany, 2011.
13. D. Canino, L. De Floriani, and K. Weiss. IA*: An adjacency-based representation for non-manifold simplicial shapes in arbitrary dimensions. *Computers & Graphics (Proceedings Shape Modeling International 2011)*, 35(3):747–753, June 2011.
14. K. Weiss and L. De Floriani. Simplex and diamond hierarchies: Models and applications. *Computer Graphics Forum*, 30(8):2127–2155, 2011.
15. K. Weiss and L. De Floriani. Isodiamond hierarchies: An efficient multiresolution representation for isosurfaces and interval volumes. *IEEE Transactions on Visualization and Computer Graphics*, 16(4):583 – 598, July-August 2010.
16. K. Weiss and L. De Floriani. Diamond hierarchies of arbitrary dimension. *Computer Graphics Forum (Proceedings Symposium on Geometry Processing 2009)*, 28(5):1289–1300, July 2009.
17. K. Weiss and L. De Floriani. Supercubes: A high-level primitive for diamond hierarchies. *IEEE Transactions on Visualization and Computer Graphics (Proceedings IEEE Visualization 2009)*, 15(6):1603–1610, November-December 2009.

Refereed Conference Publications

18. R. Yeh, K. Weiss, A. Capps, and X. Tricoche. Multimat: An API for managing multimaterial simulation data. In *Proceedings of the 29th International Meshing Roundtable*, October 2021.

19. D. Boehme, P. Aschwanden, O. Pearce, K. Weiss, and M. LeGendre. Ubiquitous Performance Analysis. In *Lecture Notes in Computer Science*, volume 12728 of *ISC High Performance 2021*, pages 431–449. Springer, 2021.

20. R. Fellegara, F. Iuricich, L. De Floriani, and K. Weiss. Efficient computation and simplification of discrete Morse decompositions on triangulated terrains. In *Proceedings ACM SIGSPATIAL GIS*, ACM SIGSPATIAL '14. ACM, November 2014.

21. L. De Floriani, F. Iuricich, R. Fellegara, and K. Weiss. A spatial approach to morphological feature extraction from irregularly sampled scalar fields. In *Proceedings of the Third ACM SIGSPATIAL International Workshop on GeoStreaming*, IWGS '12, pages 40–47, New York, NY, 2012. ACM.

22. K. Weiss, R. Fellegara, L. De Floriani, and M. Velloso. The PR-star Octree: A spatio-topological data structure for tetrahedral meshes. In *Proceedings ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems*, ACM GIS '11, pages 92–101, Chicago, IL, November 1–4 2011. ACM

23. M. A. Yalçın, K. Weiss, and L. De Floriani. GPU algorithms for diamond-based multiresolution terrain processing. In *Eurographics Symposium on Parallel Graphics and Visualization*, EGPVG '11, pages 121–130, Bangor, Wales, April 10–11 2011.

24. K. Weiss and L. De Floriani. Bisection-based triangulations of nested hypercubic meshes. In S. Shontz, editor, *Proceedings 19th International Meshing Roundtable*, IMR '10, pages 315–333, Chattanooga, Tennessee, October 3–6 2010.

25. K. Weiss, L. De Floriani, and M. Mesmoudi. Multiresolution analysis of 3D images based on discrete distortion. In *International Conference on Pattern Recognition*, ICPR '10, pages 4093–4096, Istanbul, Turkey, August 2010. IEEE Computer Society.

26. K. Weiss and L. De Floriani. Simplex and diamond hierarchies: Models and applications. In H. Hauser and E. Reinhard, editors, *Eurographics 2010 - State of the Art Reports*, EG STAR '10, pages 113–136, Norrköping, Sweden, 2010. Eurographics Association. (*Refereed proposal*).

27. K. Weiss and L. De Floriani. Sparse terrain pyramids (BEST PAPER AWARD). In *Proceedings ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems*, ACM GIS '11, pages 115–124, Irvine, CA, 2008. ACM.

28. K. Weiss and L. De Floriani. Multiresolution interval volume meshes. In H.-C. Hege, D. Laidlaw, R. Pajarola, and O. Staadt, editors, *IEEE/ EG Symposium on Volume and Point-Based Graphics*, EG PBGVG '08, pages 65–72, Los Angeles, California, USA, 2008. Eurographics Association.

29. K. Weiss and L. De Floriani. Modeling and visualization approaches for time-varying volumetric data. In G. Bebis, R. Boyle, B. Parvin, D. Koracin, P. Remagnino, F. Porikli, J. Peters, J. Klosowski, L. Arns, Y. Chun, T. Rhyne, and L. Monroe, editors, *Advances in Visual Computing (ISVC '08)*, volume 5359 of *Lecture Notes in Computer Science*, pages 1000–1010. Springer, 2008.

30. L. Yin and K. Weiss. Generating 3D views of facial expressions from frontal face video based on topographic analysis. In *Proceedings ACM international conference on Multimedia*, ACM SIGMM '04, pages 360–363, New York, NY, USA, 2004. ACM.

Refereed Book Chapters

31. L. De Floriani, F. Iuricich, P. Magillo, M. Mesmoudi, and K. Weiss. Discrete distortion for 3D data analysis. In L. Linsen, H. Hagen, B. Hamann, and H.-C. Hege, editors, *Visualization in Medicine and Life Sciences II*, Mathematics and Visualization, pages 3–25. Springer Verlag, Berlin Heidelberg, 2011.

Refereed Short Papers, Posters and Extended Abstracts (selected)

32. S. Dempsey, D. Hawkins, R. Rieben, T. Stitt, K. Weiss, G. Becker, R. Butler, T. Gamblin, and P. Scheibel. A Spack-driven build system for Marbl: Challenges, features and opportunities. In *J34 Applied Computer Science*, Livermore, CA, Mar. 2023.

33. D. Hawkins, S. Brink, S. Dempsey, O. Pearce, R. Rieben, T. Stitt, and K. Weiss. Containerized Marbl scaling on AWS. In *J34 Applied Computer Science*, Livermore, CA, Mar. 2023.

34. K. Belcher, A. Campos, S. Dempsey, P. Mocz, R. Rieben, A. Skinner, T. Stitt, A. Vargas, and K. Weiss. Halfway to El Capitan: Marbl's progress on AMD GPU early access machines. In *J34 Applied Computer Science*, Livermore, CA, Mar. 2023.

35. J. Liu, K. K. Weiss, and J. Yao. Feature preserving interface reconstruction and tracking using piecewise circular facets with cusps. In *10th International Conference on Numerical Methods for Multi-Material Fluid Flow*, MultiMat 2022, Zurich, August 2022.

36. D. Gunderman, K. Weiss, and J. A. Evans. High-order mesh-free numerical quadrature for trimmed curved parametric domains. In *Solid and Physical Modeling (SPM) Posters*, Strasbourg, France, June 2–4 2020.

37. K. Weiss, J. Yao, and D. Gunderman. Exact intersections and moments of high order elements. In *LLNL Board of Governors Science and Technology Review*. 2019.

38. R. Fellegara, K. Weiss, and L. De Floriani. An efficient approach for verifying manifold properties of simplicial complexes. In S. Canann, editor, *Proceedings 25th International Meshing Roundtable*, IMR '16, Washington, D.C., September 27–30 2016.

39. K. Weiss, G. Zagaris, R. Rieben, and A. Cook. Spatially accelerated shape embedding in multimaterial simulations. In S. Canann, editor, *Proceedings 25th International Meshing Roundtable*, IMR '16, Washington, D.C., September 27–30 2016.

40. E. DeSantola, J. Backes, G. Zagaris, K. Weiss, M. Larsen, and C. Harrison. Accelerated signed distance queries for performance portable multimaterial simulations. In *Supercomputing (Posters)*, SC, Salt Lake City, UT, Nov 13–18 2016. ACM.

41. K. Weiss and P. Lindstrom. Adaptive Regular Simplex Bisection (RSB) wavelets. In *NSF Workshop on Barycentric Coordinates in Geometry Processing and Finite/Boundary Element Methods*, New York, NY, July 25–27 2012.

42. K. Weiss and L. De Floriani. Nested refinement domains for tetrahedral and diamond hierarchies. In *IEEE Visualization 2010 Poster Compendium*, IEEE VIS '10, Salt Lake City, Utah, October 24–29 2010.

43. L. Yin, K. Weiss, and X. Wei. Face modeling from frontal face image based on topographic analysis. In *ACM SIGGRAPH Posters*, page 86, New York, NY, USA, 2004. ACM.

Technical Reports

44. B. S. Ryujin, A. Vargas, I. Karlin, S. A. Dawson, K. Weiss, A. Bertsch, M. S. McKinley, M. R. Collette, S. D. Hammond, K. Pedretti, and R. N. Rieben. Understanding power and energy utilization in large scale production physics simulation codes. January 2022.

45. D. Richards, B. Ryujin, N. Barton, S. Bastea, B. Beauchamp, B. Beck, D. Beckingsale, R. Blake, P. Brantley, P. Brown, J. Burmark, R. Carson, E. Chen, M. Collette, S. Dawson, L. Fried, G. Gert, J. Grondalski, J. Gyllenhaal, B. Hall, R. Haque, B. Isaac, M. Katz, A. Kunen, I.-F. Kuo, H. Le, J. Loffeld, C. Mattoon, M. McFadden, S. McKinley, M. Meraz-Rodriguez, D. Miller, P. Minner, R. Nimmakayala, C. Noble, M. O'Brien, M. Osawe, M. Patel, M. Pozulp, B. Pudliner, V. Rana, R. Rieben, P. Robinson, A. Skinner, D. Slone, B. Stephens, P. Sterne, D. Stevens, T. Stitt, A. Vargas, B. Wayne, K. Weiss, C. White, R. Whitesides, M. Yang, and B. Yee. Enhancements supporting IC usage of PEM libraries on next-gen platforms. Technical report, June 2021.

46. R. Anderson, A. Black, L. Busby, B. Blakeley, R. Bleile, J.-S. Camier, J. Ciurej, A. Cook, V. Dobrev, N. Elliott, J. Grondalski, C. Harrison, R. Hornung, T. Kolev, M. Legendre, W. Liu, W. Nissen, B. Olson, M. Osawe, G. Papadimitriou, O. Pearce, R. Pember, A. Skinner, D. Stevens, T. Stitt, L. Taylor, V. Tomov, R. Rieben, A. Vargas, K. Weiss, and D. White. The Multiphysics on Advanced Platforms Project (MAPP). Technical report, November 2020.

Invited Talks, Presentations and Tutorials *(selected)*

- A geometry-based approach to initializing volume fractions in multimaterial simulations. In *J34 Applied Computer Science*. Albuquerque, NM, February 29 2024.
- HPC and modular CS infrastructure in WSC: A story in three vignettes. In *NECDC 2023*. Los Alamos, NM, October 2023.
- Leveraging robust, flexible software components for scientific applications with Axom. In *RADIUSS AWS Tutorial*. Livermore, CA (virtual), August 24 2023.
- Update on the MARBL multi-physics code: Performance, portability and scaling. In *ASC PI Meeting*. Monterey, CA, May 17 2022. *Also presented at 2022 ECP Annual Meeting*.
- Accurate "shaping" of curved interfaces into curved high order meshes. In *NECDC 2021 (virtual)*. Livermore, CA (virtual), May 2021.
- Node-to-node scaling studies. In *J34 Applied Computer Science Meeting*. Albuquerque, NM (virtual), February 23 2021.
- Towards a shared shaping capability. In *ASC L2 Milestone*. Livermore, CA (virtual), August 31 2021.
- Demonstration of multiple, modular physics capabilities integrated into the NextGen code. In *LLNL ATDM FY21 L2 Milestone*. Livermore, CA (virtual), August 25 2021.
- The Multiphysics on Advanced Platforms Project: Modular CS capabilities, workflow and productivity improvements. In *LLNL ATDM L1 Milestone Review*. Albuquerque, NM (virtual), December 2020.
- The low-down on high-order at LLNL. In *J34 Applied Computer Science*. Livermore, CA, February 7 2020.
- MIRML: Material Interface Reconstruction using Machine Learning. In *LLNL ASC Machine Learning Workshop*. Livermore, CA, September 19 2019.
- Modularity... at a cost. In *J34 Applied Computer Science*. Los Alamos, NM, January 31 2019.
- Tracer particles on high-order curved meshes. In *NECDC 2018*. Los Alamos, NM, October 2018.
- Point-in-cell query for high-order meshes. In *Computation Directoriate External Review Committee (ERC)*. Livermore, CA, August 28 2018.
- SLAM: A Set-theoretic Lightweight API for Meshes. In *J34 Applied Computer Science*. Livermore, CA, February 7 2017.
- Implicit functions for embedded geometries in multi-material simulations. In *NECDC 2016*. Livermore, CA, October 2016.
- Visualizing hierarchical performance data with nested stacked bar charts. In *ASQ Exascale joint code meeting*. LLNL, Livermore, CA, September 23 2015.
- Leveraging web technologies for rapid visual debugging. In *ASQ code collaboration meeting*. LLNL, Livermore, CA, March 10 2015.
- Adaptive multilinear tensor product wavelets. In *IEEE Visualization 2015*. Chicago, IL, October 29 2015.
- Fine-grained multiresolution hierarchies for scientific visualization. In *SLAC Early Career Scientist Associate Forum*. Stanford University, October 4 2013.
- Efficient and effective mesh representations for shape modeling and analysis. In *Symposium for Geometry Processing (SGP) Graduate School*. Eurographics Association, July 1 2013.
- A primal/dual representation for discrete Morse complexes on tetrahedral meshes. In *Eurovis 2013*. Eurographics, Leipzig, Germany, June 20 2013.
- The PR-star Octree: A spatio-topological data structure for tetrahedral meshes. In *ACM SIGSPATIAL GIS 2011*. ACM, Chicago, IL, November 2 2011.

- Diamond based models for scientific visualization. In *The Technion Pixel Club*. Technion – Israel Institue of Technology, Haifa, Israel, June 27 2011.
- IA*: An adjacency-based representation for non-manifold simplicial shapes in arbitrary dimensions. In *Shape Modeling International (SMI) 2011*. Herzliya, Israel, June 24 2011.
- GPU algorithms for diamond-based multiresolution terrain processing. In *Eurographics Symposium on Parallel Graphics and Visualization (EGPGV) '11*. Llandudno, Wales, April 11 2011.
- Bisection-based triangulations of nested hypercubic meshes. In *19th International Meshing Roundtable (IMR)*. Chattanooga, TN, October 6 2010.
- Simplex and diamond hierarchies: Models and applications. In *Eurographics State of the Art Reports '10*. Norrköping, Sweden, May 6 2010.
- Supercubes: A high-level primitive for diamond hierarchies. In *IEEE Visualization '09*. Atlantic City, NJ, October 16 2009.
- Diamond hierarchies of arbitrary dimension. In *Symposium on Geometry Processing (SGP) '09*. Berlin, Germany, July 16 2009.
- Sparse terrain pyramids. In *ACM SIGSPATIAL GIS '08*. Irvine, CA, November 6 2008.
- Multiresolution interval volume meshes. In *IEEE/EG Symposium on Volume and Point-Based Graphics (EGPGV) '08*. Los Angeles, CA, August 10 2008.
- Sound technology in games. In *Graphics Seminar Series*. University of Maryland, College Park, College Park, MD, April 16 2007.
- Decomposition and compression of regularly sampled geometry. In *Graphics Seminar Series*. University of Maryland, College Park, College Park, MD, May 1 2006.

Activities and Service

Advising

David Gunderman (co-advised Ph.D. with John Evans)
Dept. of Applied Math, CU Boulder – graduated 2021.

Riccardo Fellegara (co-advised Ph.D. with Leila De Floriani)
Department of Informatics, Bioengineering, Robotics and Systems Engineering (DIBRIS), University of Genova – graduated 2014.

Summer students

Jacob Spainhour (CU Boulder) – Summers 2022 & 2023

David Gunderman (CU Boulder) – Summers 2019, 2020 & 2021

Jerry Liu (Duke) – Summers 2020 & 2021

Jennifer Fromm (UCSD) – Summers 2020 & 2021

Marko Sterbentz (Northwestern) – Summer 2019

Hirish Chandrasekaran (UCSB) – Summer 2018

Raine Yeh (Purdue) – Summers 2017 & 2018

Austin Stromme (UW-Seattle) – Summer 2017

Jordan Backes (U. Missouri) – Summer 2016

Evan DeSantola (CMU) – Summer 2016

Journal Editorial Boards

ACM Transactions on Spatial Algorithms and Systems (TSAS) – Information director, 2012 – PRESENT.

Conference Program Committees

EuroVis Conference (Short Papers) – 2020-PRESENT.

International Conference on Image Analysis and Processing (ICIAP) – 2015

Eurographics Conference (Short Papers) – 2012-2014.

Eurographics Italian Chapter Conference – 2011, 2010.

Peer Reviewing

Journals

ACM Transactions on Graphics (ToG)

ACM Transactions Spatial Algorithms and Systems (TSAS)

IEEE Transactions on Visualization and Computer Graphics (TVCG)

Computer Graphics Forum

Graphical Models (GMOD)

Computers & Graphics

Computers & Geosciences

Computer Physics Communications (COMPHY)

The Visual Computer

Computer Aided Design (CAD) Journal

Conferences

ACM SIGGRAPH and SIGGRAPH Asia

IEEE Visualization

Eurographics

Symposium on Geometry Processing (SGP)

Shape Modeling International (SMI)

ACM SIGSPATIAL GIS

Computer Graphics International (CGI)

Eurographics Symposium on Parallel Graphics and Visualization (EGPGV)

International Meshing Roundtable (IMR)

Eurographics/IEEE Symposium on Visualization (EuroVis)

IEEE/EG International Symposium on Volume Graphics

Mathematics of Surfaces

Solid and Physical Modeling (SPM)

International Symposium on Visual Computing (ISVC)

Pacific Graphics

Pacific Visualization (PacificVis)