

# Ryan Kautzman

Senior / Principal Software Engineer – Simulation, Graphics & High-Performance Systems  
San Francisco Bay Area

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## SUMMARY

Senior / Principal Software Engineer with 26 years of experience building production-grade simulation, graphics, and deformation systems at the intersection of **AI, real-time engines, and physically based modeling**. Deep expertise in **C++**, **Unreal Engine**, **FEM**, **tetrahedral meshing**, **USD pipelines**, and **high-performance systems**, with a track record of translating research into scalable products, bridging the gap between research, production, and real-time deployment. Proven technical leader across film, games, and research organizations including **Meta**, **Epic Games**, **Pixar**, and **ILM**. Particularly effective in early-stage and R&D-heavy environments where ambiguous problems require strong architectural judgment.

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## EXPERIENCE

### Meta – Reality Labs Research (Gemini/PhysicsAI)

Software Engineer, Digital Humans | Apr 2024 – March 2026 | Sausalito, CA

- Designed and implemented **GeometryDB**, a graph-based C++ procedural execution framework with parallel evaluation, invalidation, Python bindings, and Rerun-based visualization, enabling rapid iteration on real-time deformation and simulation workflows.
    - Built a **real-time proximity deformer** supporting barycentric linear and Procrustes methods, including procedurally generated parent/child bindings for complex character setups.
    - Developed GPU-accelerated cloth and flesh simulation improvements, including **global intersection analysis**, **flypapering**, **CUDA-based inertial compensation**, and **ARAP constraints for tetrahedral meshes**.
      - Integrated **Meta Avatars 2 SDK** into a distributed evaluation system (Gravity).
      - Reverse engineered Unreal Engine 5's runtime groom system to enable **dynamic hairstyle switching** at runtime.
      - Work supports ongoing research and production pipelines for next-generation digital human simulation at scale.
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### Epic Games

Senior Physics Software Engineer | Nov 2018 – Oct 2023 | Larkspur, CA

- Served as **project lead for Chaos Flesh**, a real-time tetrahedral FEM simulator, and skeletal muscle system integrated into Unreal Engine 5, including Anim Deformer Graph integration.
  - Collaborated with academic partners (Stanford, UC Davis) on advanced FEM solvers, resulting in a **real-time XPBD-based FEM system** showcased in the UE 5.2 Rivian demo.
  - Built a **USD-based simulation caching pipeline** with custom tetrahedral mesh primitives, supporting monolithic and value clip formats.
  - Developed the **Jiggle Spring Deformer**, a real-time ballistic spring system derived from higher-order offline FEM models and deployed via Unreal ML Deformer.
  - Contributed to Chaos Destruction with performance profiling, parallelization, and algorithmic improvements including vertex decimation and importance ordering.
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## Pixar Animation Studios

**Senior Software Engineer** | Dec 2005 – Nov 2018 | Emeryville, CA

- Technical lead and architect of the **Physics Abstraction Layer (PAL)**, a feature rich C++ simulation scene graph with Python bindings used across nearly every Pixar film from *Toy Story 3* through *Incredibles 2*.
  - Led development of **skin, flesh, cloth, fluid, and rigid-body simulators** for multiple feature films, including *WALL-E*, *Up*, *Brave*, *Finding Dory*, and *Incredibles 2*.
  - Co-invented **rest state retargeting** for finite elements, enabling art-directable secondary motion while preserving animated shape targets.
  - Re-architected PhysBAM deformables for scalability, adding parallel force evaluation, hybrid bindings, JIT C++ procedural nodes, and on-the-fly remeshing; enabling large-scale parameter sweeps and simulation driven workflows.
  - Delivered distributed MPI-based fluid simulation systems running across dozens of machines for large-scale production shots.
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## Industrial Light & Magic (ILM)

**R&D Software Engineer** | 2000 – 2005 | San Rafael, CA

- Developed cloth, flesh, and deformable body simulation tools used in films including *Van Helsing*, *Pirates of the Caribbean*, *Star Wars: Episode III*, and *Harry Potter*.
  - Collaborated with Prof. Ron Fedkiw on early flesh simulation systems that became studio-wide standards.
  - Built real-time previs and production tracking systems, spanning Java/Oracle backends and custom visualization tools.
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## PUBLICATIONS & PATENTS

- SIGGRAPH 2018 – [Robust Skin Simulation in Incredibles 2](#)
- SIGGRAPH 2016 – [Finding Hank: Or How to Sim An Octopus](#)
- SIGGRAPH 2012 – [Stable, Art-Directable Skin and Flesh Using Biphasic Materials](#)

- SIGGRAPH 2008 – [Simulating the Devolved: Finite Elements on WALL-E](#)
  - SIGGRAPH 2004 – [Jiggly Bits and Motion Retargeting](#)
  - 5 Issued U.S. Patents in FEM-based skin and flesh, and fluid simulation (see LinkedIn profile)
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## TECHNICAL SKILLS

- **Languages:** C++, Python, CUDA, HLSL, and exposure to others.
  - **Engines & Frameworks:** Unreal Engine 5, USD, PhysBAM, STL, Boost, Folly
  - **Domains:** flesh/muscle/cloth/skin/hair simulation, Finite Element Methods, tetrahedral meshing, collision detection, real-time deformation
    - **Systems:** Multithreading (TBB/Dispenso/etc), MPI, GPU compute, distributed simulation pipelines
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## EDUCATION

**University of California, Davis**

B.S. Computer Science – Emphasis in Computer Graphics & Scientific Visualization | 2000

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## SELECTED CREDITS

ILM: *Hulk*, *Van Helsing*, *Harry Potter III*, *Star Wars Episode III*

Pixar: *Incredibles 2*, *Finding Dory*, *The Good Dinosaur*, *Brave*, *Up*, *WALL-E*

Epic Games: *Unreal Engine* [Chaos Destruction Demo](#), [Rivian R1T Demo](#)

*Additional screen credits:* <https://www.imdb.com/name/nm1380511>