Ryan Kautzman

Senior / Principal Software Engineer – Simulation, Graphics & AI Systems
San Francisco Bay Area | tinymonkey@gmail.com | 415.717.1614 | LinkedIn: ryan-kautzman-4a71412

SUMMARY

Senior / Principal Software Engineer with 20+ 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.

EXPERIENCE

Meta – Reality Labs Research (Gemini/PhysicsAI)

Software Engineer, Digital Humans | Apr 2024 – Present | 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.

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.

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.

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.

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)

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

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