RYAN KAUTZMAN
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PIXAR ANIMATION STUDIOS

SENIOR SOFTWARE ENGINEER

December 2005 – present

- PhysBAM FEM based skeletal muscle simulation for *Incredibles 2* / R&D Collaboration
  - __Stable Neo-Hookean FEM constitutive model
  - __Quasistatic and ballistic

- Skin simulators for *Finding Dory* and *Incredibles 2* / Project Lead
  - __Geodesic and raytracing sliding algorithms
  - __Procedural constraints and sliding limits
  - __Analytic inverse Phong projection

- Deformable simulation infrastructure for *Finding Dory* / Project Lead
  - __Redesign of PhysBAM's deformables, focused on parallelism and flexibility
  - __Lock free TBB concurrent force evaluation scheduler; CCD, force, and integration loop parallelization
  - __Arbitrary and time independent meshes, bindings, and force topologies
  - __Continual frame relative restaging
  - __On-the-fly re-meshing
  - __C++ JIT plugins

- Cloth/fluid feather, hair/fluid, and rigid body tentacle prototypes / Special Projects

- USD based sim pipeline / Software Engineer
  - __Transitioned cloth, hair, flesh, rigid, and vegetation simulators to USD

- Procedural tetrahedral and triangular meshing pipeline / Project Lead
  - __Tet mesh construction, refinement, culling, conforming, cutting, and cache coherency optimization
  - __Multi-layer thin wall tet meshes
  - __Stochastic and edge collapsing triangle mesh simplification, and hexahedral re-meshing routines

- AutoPAL: automatic bindings of the PAL scene graph into Presto / Project Lead
  - __Reduced Presto prim specification from hundreds to thousands of lines of code, to about five to ten

- MPI distributed fluids for *Brave* / Project Lead
  - __Houdini front end controlling PhysBAM PLS, running typically across 64 machines for extended time periods
  - __Single phase, multi-phase, and viscoelastic
  - __Comm layer built on custom HTTP server facilitated large data set transfer and distribution, coalescing, and compression, as well as monitoring and control
  - __Implemented a generalized field API, a 'windowed' source, divergence fields, static and deforming colliders, etc.

- PAL Solids / Software Engineer & Project Lead
  - __PAL based deformable and rigid body simulator built around PhysBAM
  - __Designed skin simulator and oversaw implementation

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PIXAR ANIMATION STUDIOS, CONT'D

- Physics Abstraction Layer (PAL) / Project Lead

  __Light weight scene graph for simulation, built in C++ with python bindings

  __Factory based contextual or manual scene construction, automatic multistep data type conversions, temporal and spatial interpolation, data and scene validation, serialization, integrated user documentation, logging, and statistic gathering

  __Simulator, front end (Maya, Houdini, Presto, Python, etc.), and execution mode (interactive, realtime, batch, etc.) agnostic

- FEM and rigid body simulators for *WALL-E*, *Up* and *Toy Story 3* / Software Engineer

  __Co-invented rest state retargeting for finite elements

  __Articulated and force based angular rigid body constraints

- Kingpin 2 design / Architect

  __Requirement spec, design doc, and API spec for python based simulation infrastructure within Marionette

- Driving system for *WALL-E* / Software Engineer

  __Built a threaded, time budgeted path tracing widget in Marionette for all robots on WALL-E

- Wiggly splines / Software Engineer

  __Built a front end for a modal decomposition and subspace deformation experiment with Research

INDUSTRIAL LIGHT & MAGIC

R&D SOFTWARE ENGINEER

June 2000 – December 2005

- Deformable simulation infrastructure in Zeno / Software Engineer

  __Mass-spring cloth and flesh systems

- Caricature flesh development for *Van Helsing* / Project Lead

  __Unconditionally stable flesh system developed with Prof. Ron Fedkiw

- Caricature cloth development / Software Engineer

  __Rigid and deforming volumetric collision objects, and geometric repulsion bodies

  __Integrated Bridson style continuous collision detection

  __Adaptive subdivision collision detection

  __Implemented an adaptive time stepping scheme and CFL conditions

- Real time previsualization / Project Lead

  __On-set previs system built on top of XSI game engine for Director Ang Lee

  __Built a camera capture system with a non-linear editor

- Timecard and M-Tools / Software Engineer

  __Web based timecard and production tracking system, with a Java backend

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PUBLICATIONS

"ROBUST SKIN SIMULATION IN *INCREDIBLES 2*"

SIGGRAPH 2018, Talks

Authors: Ryan Kautzman, Gordon Cameron, Theodore Kim

http://tinymonkey.org/publications/Incredibles2_RobustSkinSimulationInIncredibles2_SIGGRAPH18.pdf

"FINDING HANK: OR HOW TO SIM AN OCTOPUS"

SIGGRAPH 2016, Talks

Authors: Ryan Kautzman, Bill Wise, Meng You, Per Karlsson, Mark Hessler, Audrey Wong

http://tinymonkey.org/publications/FindingDory_FindingHankOrHowToSimAnOctopus_SIGGRAPH2016.pdf

"STABLE, ART-DIRECTABLE SKIN AND FLESH USING BIPHASIC MATERIALS"

SIGGRAPH 2012, Talks

Authors: Ryan Kautzman, Jiayi Chong, Patrick Coleman

http://tinymonkey.org/publications/Brave_BiphasicSkinAndFlesh_SIGGRAPH12.pdf

"SIMULATING THE DEVOLVED: FINITE ELEMENTS ON *WALL-E*"

SIGGRAPH 2008, Sketches

Authors: Geoffrey Irving, Ryan Kautzman, Gordon Cameron, Jiayi Chong

http://tinymonkey.org/publications/Walle_SimulatingTheDevolved_SIGGRAPH08.pdf

"JIGGLY BITS AND MOTION RETARGETING"

SIGGRAPH 2004, Sketches

Authors: Ryan Kautzman, Andrea Maiolo, Doug Griffin, Andy Buecker

http://tinymonkey.org/publications/VanHelsing_JigglyBits_SIGGRAPH04.pdf

PATENTS

- US9251618B2
  Skin and flesh simulation using finite elements, biphasic materials, and rest state retargeting.
- US8847963B1
  Systems and methods for generating skin and volume details for animated characters.
- US8290757B2
  Method, system and computer readable media for deforming simulation meshes used in posing animated characters. (Rest state retargeting)
- US20140005994A1
  Windowed simulation in fluid flows.

EDUCATION

UNIVERSITY OF CALIFORNIA, DAVIS

Degree: Bachelor of Science in Computer Science / June 2000

Major: Computer Science

Emphasis: Computer Graphics and Scientific Visualization

PROGRAMMING LANGUAGES & RELEVANT API'S

- C/C++, Java, JSP, JavaScript, Python, SQL, PHP, HTML, CSS, csh & bash scripting (reluctantly)
- PhysBAM (Fedkiw et al, dynamics libraries), STL, Boost, TBB, USD, MPI, and many more...

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FILM CREDITS

PIXAR

Incredibles 2 (2018)
Coco (2017)
Cars 3 (2017)
Finding Dory (2016)
The Good Dinosaur (2015)
Inside Out (2015)
Monsters University (2013)
Brave (2012)
Cars 2 (2011)
Toy Story 3 (2010)
Up (2009)
WALL-E (2008)
Ratatouille (2007)

ILM

Van Helsing (2004)
The Hulk (2003)
Planet of the Apes (2001)
Plus lots and lots of uncredited work on *Pirates of the Caribbean 1 & 2*, *The Chronicles of Narnia*, *The Island*, *War of the Worlds*, *Star Wars: Episode III*, and *Harry Potter 3 & 4*.

PERSONAL MANTRAS

1) A good idea is a good idea no matter where it comes from
2) Always give credit where credit is due
3) Relentlessly take the high road
4) If a job is worth doing, then it's worth doing right

And many others I'm continually trying to imprint on the psyche of my kids...