

# Alexey Stomakhin

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## Experience

### Senior Simulation Researcher, [Weta Digital](#)

Jan 2018 – present

### Senior Software Engineer, [Walt Disney Animation Studios](#)

Jul 2013 – Jan 2018

Devise, plan, execute and lead research and software projects for production needs

#### Led research, development and deployment of material point method (MPM) simulation tools

Developed and implemented MPM snow simulator with an elasto-plastic constitutive model that allowed better realism than any previous method. Optimized and extended the method to handle granular and viscoelastic materials, phase change, as well as interaction with cloth and volumetric Lagrangian solids. Built as a Houdini plugin. Published multiple SIGGRAPH papers.

#### Architected and led development of production water system

Developed a new artist friendly deep water wave system, boat buoyancy simulator for layout, a novel distributed fluid simulator, a.k.a. Splash, based on dissipation reducing affine particle-in-cell (APIC) research and fluxed animated boundary (FAB) method for artistic control, as well as implicit surface compositing and rendering system. Partially used for Zootopia (2016) and fully deployed on Moana (2016). Led to “Best of Disney” award and published in SIGGRAPH.

#### Shot and production work

Used simulators to perform shot work for Disney's Frozen (2013) and Moana (2016).

### Software Engineer / Consultant, [Walt Disney Animation Studios](#)

Feb 2013 – May 2013

Devise, plan, execute and lead research and software projects for production needs

Implemented the original Disney's material point method (MPM) snow solver, a.k.a. Matterhorn. Integrated the solver into the production rig for deep snow effects in Disney's Frozen (2013).

### Graduate Research Intern, [Walt Disney Animation Studios](#)

Jun 2012 – Sep 2012

Provide math and physical simulation expertise, fulfill production needs

Optimized Disney's Maya plugin for physically-based character skinning, a.k.a. PhysGrid, via efficient stencil computation and parallelization/vectorization on a CPU.

### Graduate Research Intern, [Walt Disney Animation Studios](#)

Jul 2011 – Sep 2011

Provide math and physical simulation expertise, fulfill production needs

Implemented and analyzed performance of multigrid solvers for physically-based character skinning.

### Research Fellow, [University of California, Los Angeles](#)

Jun 2010 – Jun 2013

Research, develop and publish new simulation technology

Developed expertise in constitutive modeling for solids simulation in graphics.

Developed the original material point method (MPM) solver for snow simulation.

Researched new simulation technologies and published several computational physics and graphics papers.

Researched and published on inverse problems, statistics and social networks.

Teaching fellow for numerical analysis, ODE/PDE and programming classes.

### Undergraduate Intern, [Intel Corporation](#)

Apr 2008 – Jul 2009

Developed and implemented an automatic verification and graphical representation systems for a processor performance model.

## Education

- Ph.D., M.A. Mathematics, [University of California, Los Angeles](#)** Aug 2009 – Jun 2013  
Area of Specialization: Applied and Computational Mathematics.  
Advisors: Joseph Teran and Andrea Bertozzi.
- B.S. Applied Mathematics and Physics, [Moscow Institute of Physics and Technology](#)** Sep 2005 – Jun 2009  
Graduated with Honors. Minor: Computer Science and Electrical Engineering.

## Publications

- [Fluxed Animated Boundary Method](#)**. A. Stomakhin, A. Selle. ACM SIGGRAPH 2017.
- [Moana: Crashing Waves](#)**. D.J. Byun, A. Stomakhin. ACM SIGGRAPH 2017 (Talks).
- [Moana: Performing Water](#)**. B. Frost, A. Stomakhin, H. Narita. ACM SIGGRAPH 2017 (Talks).
- [Rigging the Oceans of Disney's "Moana"](#)**. J. Garcia, S. Palmer, S. Drakeley, D. Hutchins, E. Ramos, R. Habel, A. Stomakhin. SIGGRAPH Asia 2016 (Technical briefs).
- [The Material Point Method for Simulating Continuum Materials](#)**. C. Jiang, C. Schroeder, J. Teran, A. Stomakhin, A. Selle. ACM SIGGRAPH 2016 (Courses).
- [Flesh, Flab, and Fascia Simulation on Zootopia](#)**. A. Milne, M. McLaughlin, R. Tamstorf, A. Stomakhin, N. Burkard, M. Counsell, J. Canal, D. Komorowski, E. Goldberg. ACM SIGGRAPH 2016 (Talks).
- [The Affine Particle-In-Cell Method](#)**. C. Jiang, C. Schroeder, A. Selle, J. Teran, A. Stomakhin. ACM SIGGRAPH 2015.
- ["Big Hero 6": Into the Portal](#)**. D. Hutchins, O. Riley, J. Erickson, A. Stomakhin, R. Habel, M. Kaschalk. ACM SIGGRAPH 2015 (Talks).
- [Material Point Method for Viscoelastic Fluids, Foams and Sponges](#)**. D. Ram, T. Gast, C. Jiang, C. Schroeder, A. Stomakhin, J. Teran, P. Kavehpour. Eurographics Symposium on Computer Animation (SCA) 2015.
- [Optimization Integrator for Large Time Steps](#)**. T. Gast, C. Schroeder, A. Stomakhin, C. Jiang, J. Teran. IEEE TVCG 2015.
- [Augmented MPM for Phase-Change and Varied Materials](#)**. A. Stomakhin, C. Schroeder, C. Jiang, L. Chai, J. Teran, A. Selle. ACM SIGGRAPH 2014.
- [A Second Order Virtual Node Algorithm for Navier-Stokes Flow Problems with Interfacial Forces and Discontinuous Material Properties](#)**. C. Schroeder, A. Stomakhin, R. Howes, J. Teran. Journal of Computational Physics 2014.
- [A Material Point Method for Snow Simulation](#)**. A. Stomakhin, C. Schroeder, L. Chai, J. Teran, A. Selle. ACM SIGGRAPH 2013.
- [Energetically Consistent Invertible Elasticity](#)**. A. Stomakhin, R. Howes, C. Schroeder, J. Teran. Eurographics Symposium on Computer Animation (SCA) 2012.
- [Reconstruction of Missing Data in Social Networks Based on Temporal Patterns of Interactions](#)**. A. Stomakhin, M. Short, and A. Bertozzi. Inverse Problems 2011.

## Awards

- Horn-Moez prize for excellence in first year graduate studies, UCLA, 2010.
- "Best of Disney" technology award for developing a fluid simulation system, The Walt Disney Company, 2016.

## Patents

Material point method for simulation of granular materials (20150187116).  
Augmented material point method for simulating phase change and varied materials (20150186565).  
Adaptive material point method (20160210384).  
Particle-in-cell methods preserving shearing and rotation (20170185701).  
Geometric multigrid on incomplete linear octrees for simulating deformable animated characters (20160292902).  
Guided simulation with generalized collision objects (20180075173).

## Film credits

Frozen (2013), Big Hero 6 (2014), Zootopia (2016), Moana (2016).

## Skills

Solid background in applied and computational mathematics, including research and coursework in ODEs and PDEs, numerical analysis, scientific computing, numerical linear algebra, computational solid and fluid mechanics, multigrid methods, optimization, parallel and distributed programming.

Fluent in C/C++ but also experienced with a wide range of other programming languages, packages, and paradigms; including Python, Perl, VEX, Java, Matlab/Octave, Mathematica, Maple.

**Libraries:** Boost, Maya API, Houdini API, MPI, Pthreads, OpenMP, TBB, OpenVDB, OpenEXR.

**Tools:** cmake, bash, scons, valgrind, gdb, VTune, emacs, Sublime Text, vi.

**Markup/Interchange:** HTML, XML, JSON,  $\LaTeX$ , PostScript.

**Environments:** Linux, Mac OS X, UNIX, Windows.

**Version control:** Git, SVN.

## References

Available upon request.