

Stanford



Ron Fedkiw

Canon Professor in the School of Engineering
Computer Science

CONTACT INFORMATION

- **Administrator**

Alexis Wing - Administrative Associate

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Bio

BIO

Fedkiw's research is focused on the design of new computational algorithms for a variety of applications including computational fluid dynamics, computer graphics, and biomechanics.

ACADEMIC APPOINTMENTS

- Professor, Computer Science
- Member, Bio-X
- Member, Institute for Computational and Mathematical Engineering (ICME)

HONORS AND AWARDS

- Award for Initiatives in Research, National Academy of Science
- Fellowship, Packard Foundation
- Presidential Early Career Award for Scientists and Engineers, National Science Foundation
- Sloan Research Fellowship, Alfred P. Sloan Foundation
- Academy Award, The Academy of Motion Picture Arts and Sciences (2007)
- Young Investigator Program Award, Office of Naval Research
- Robert N. Noyce Family Faculty Scholarship, Stanford University

PROFESSIONAL EDUCATION

- PhD, UCLA (1996)

Teaching

COURSES

2025-26

- Continuous Mathematical Methods with an Emphasis on Machine Learning: CS 205L (Win)

- Introduction to Computer Graphics and Imaging: CS 148 (Aut)

2024-25

- Continuous Mathematical Methods with an Emphasis on Machine Learning: CS 205L (Win)
- Introduction to Computer Graphics and Imaging: CS 148 (Aut)

2023-24

- Continuous Mathematical Methods with an Emphasis on Machine Learning: CS 205L (Win)
- Introduction to Computer Graphics and Imaging: CS 148 (Aut)

2022-23

- Continuous Mathematical Methods with an Emphasis on Machine Learning: CS 205L (Win)
- Introduction to Computer Graphics and Imaging: CS 148 (Aut)

STANFORD ADVISEES

Doctoral Dissertation Advisor (AC)

Sarah Jobalia, Sharon Lee, Kevli Li

Master's Program Advisor

Dina Hashash, Ethan Hsu, Jack Komaroff, Alice Liu, Megan Liu, Alex Nam, Nick Reisner, Carolyn Smith, Selena Sun

Doctoral Dissertation Co-Advisor (AC)

Zhengfei Kuang

Doctoral (Program)

Yitong Deng, Haodi He, Sarah Jobalia, Zhengfei Kuang, Kevli Li

Publications

PUBLICATIONS

- **High Resolution Sharp Computational Methods for Elliptic and Parabolic Problems in Complex Geometries** *J. Sci. Comput.*
Gibou, F., Min, C., Fedkiw, R.
2013; 54: 369-413
- **Chimera Grids for Water Simulation**
English, R., E., Qiu, L., Yu, Y.
2013
- **A Hybrid Lagrangian-Eulerian Formulation for Bubble Generation and Dynamics**
Patkar, S., Aanjaneya, M., Karpman, D., Fedkiw, R.
2013
- **A New Grid Structure for Domain Extension** *SIGGRAPH 2013, ACM TOG*
Zhu, B., Lu, W.
2013; 32: 63.1-63.8
- **Implicit Surface Tension Formulation with a Lagrangian Surface Mesh on an Eulerian Simulation Grid** *J. Comp. Phys.*
Schroeder, C., Zheng, Fedkiw, R.
2012; 231: 2092-2115
- **Simulating Free Surface Flow with Very Large Time Steps**
Lentine, M., Cong, M., Patkar, S., Fedkiw, R.
edited by Kry, P., Lee, J.

2012

- **Mass and Momentum Conservation for Fluid Simulation**

Lentine, M., Aanjaneya, M., Fedkiw, R.
edited by Bargteil, A., Panne, M., van de
2011

- **A Novel Algorithm for Incompressible Flow Using Only a Coarse Grid Projection** *SIGGRAPH 2010, ACM TOG*

Lentine, M., Zheng, W., Fedkiw, R.
2010

- **Practical Animation of Compressible Flow for Shock Waves and Related Phenomena**

Kwatra, N., Grétarsson, J., Fedkiw, R.
edited by Otaduy, M., Popovic, Z.
2010

- **Accurate Tangential Velocities for Solid Fluid Coupling**

Robinson-Mosher, A., English, E., Fedkiw, R.
edited by Grinspun, E., Hodgins, J.
2009

- **Energy Stability and Fracture for Frame Rate Rigid Body Simulations**

Su, J., Schroeder, C., Fedkiw, R.
edited by Grinspun, E., Hodgins, J.
2009

- **A Method for Avoiding the Acoustic Time-Step Restriction in Compressible Flow** *J. Comp. Phys.*

Kwatra, N., Su, J.
2009; 228: 4146-4161

- **A Mass Spring Model for Hair Simulation** *SIGGRAPH 2008, ACM TOG*

Selle, A., Lentine, M., Fedkiw, R.
2008; 27: 64.1-64.11

- **Two-way Coupling of Rigid and Deformable Bodies**

Shinar, T., Schroeder, C., Fedkiw, R.
edited by James, D., Gross, M.
2008

- **Two-way Coupling of Fluids to Rigid and Deformable Solids and Shells** *SIGGRAPH 2008, ACM TOG*

Robinson-Mosher, A., Shinar, T.
2008; 27: 46.1-46.9

- **Wrinkled Flames and Cellular Patterns** *SIGGRAPH 2007, ACM TOG*

Hong, J., M., Shinar, T., Fedkiw, R.
2007; 26: 47.1-47.6

- **Hybrid Simulation of Deformable Solids**

Sifakis, E., Shinar, T., Irving, G., Fedkiw, R.
edited by Metaxas, D., Popovic, J.
2007

- **Fracturing Rigid Materials** *IEEE TVCG*

Bao, Z., Hong, J., M.
2007; 13: 370-378

- **Volume Conserving Finite Element Simulation of Deformable Models** *SIGGRAPH 2007, ACM TOG*

Irving, G., Schroeder, C., Fedkiw, R.
2007; 26: 13.1-13.6

- **Simulating Speech with a Physics-Based Facial Muscle Model**
Sifakis, E., Selle, A., Robinson-Mosher, A., Fedkiw, R.
edited by Cani, M., P., Brien, J., O.
2006
- **So Real It'll Make You Wet** *SIGGRAPH 2006 Sketches and Applications*
Geiger, W., Leo, M.
2006
- **Impulse-Based PD Control for Joints and Muscles** *SIGGRAPH 2006 Sketches and Applications*
Weinstein, R., Guendelman, E., Fedkiw, R.
2006
- **Robust Quasistatic Finite Elements and Flesh Simulation**
Teran, J., Sifakis, E., Irving, G., Fedkiw, R.
edited by Anjyo, K., Faloutsos, P.
2005
- **Automatic Determination of Facial Muscle Activations from Sparse Motion Capture Marker Data** *SIGGRAPH 2005, ACM TOG*
Sifakis, E., Neverov, I., Fedkiw, R.
2005; 24: 417-425
- **Pre-stabilization for Rigid Body Articulation with Contact and Collision** *SIGGRAPH 2005 Sketches and Applications*
Weinstein, R., Teran, J., Fedkiw, R.
2005
- **A Fast Hybrid k-Means Level Set Algorithm for Segmentation**
Gibou, F., Fedkiw, R.
2005
- **Space Battle Pyromania** *SIGGRAPH 2005 Sketches and Applications*
Geiger, W., Rasmussen, N.
2005
- **Fast 3D Muscle Simulations using a New Quasistatic Invertible Finite-Element Algorithm**
Blemker, S., Teran, J., Sifakis, E., Fedkiw, R., Delp, S.
2005
- **Facial Muscle Activations from Motion Capture**
Sifakis, E., Fedkiw, R.
2005
- **Making a Computational Splash** *Computer Science, Reflections on the Field, Reflections from the Field*
Fedkiw, R.
The National Academies Press, Washington.2004: 61-64
- **Directible Photorealistic Liquids**
Rasmussen, N., Enright, D., Nguyen, D., Marino, S., Sumner, N., Geiger, W., Fedkiw, R.
edited by Boulic, R., Pai, D.
2004
- **Invertible Finite Elements for Robust Simulation of Large Deformation**
Irving, G., Teran, J., Fedkiw, R.
edited by Boulic, R., Pai, D.
2004
- **A Crystalline, Red Green Strategy for Meshing Highly Deformable Objects with Tetrahedra** *12th Int. Meshing Roundtable*
Molino, N., Bridson, R.
2003: 103-114

- **Using the Particle Level Set Method and a Second Order Accurate Pressure Boundary Condition for Free Surface Flows**
Enright, D., Nguyen, D., Gibou, F., Fedkiw, R.
edited by Kawahashi, M., Ogut, A., Tsuji, Y.
2003
- **Melting a Terminatrix** *SIGGRAPH 2003 Sketches and Applications*
Sumner, N., Hoon, S., Geiger, W., Marino, S., Rasmussen, N., Fedkiw, R.
2003
- **Big Bangs** *SIGGRAPH 2003 Sketches and Applications*
Geiger, W., Rasmussen, N.
2003
- **Shock Capturing, Level Sets and PDE Based Methods in Computer Vision and Image Processing: A Review on Osher's Contribution** *J. Comput. Phys.*
Fedkiw, R., Sapiro, G., Shu, C., W.
2003; 185: 309-341
- **Robust Treatment of Interfaces for Fluid Flow and Computer Graphics** *Hyperbolic Problems: Theory, Numerics, Applications, Springer-Verlag, New York*
Enright, D., Fedkiw, R.
edited by Hou, T., Tadmor, E.
Springer-Verlag, New York.2003: 153–164
- **Simulation and Animation of Fire and Other Natural Phenomena in the Visual Effects Industry** *Western States Section, Combustion Institute, Fall Meeting, UCLA*
Nguyen, D., Enright, D.
2003
- **Simulating Natural Phenomena for Computer Graphics** *Geometric Level Set Methods in Imaging, Vision and Graphics*
Fedkiw, R.
edited by Osher, S., Paragios, N.
Springer Verlag, New York.2003: 461–479
- **Simulation of Clothing with Folds and Wrinkles**
Bridson, R., Marino, S., Fedkiw, R.
edited by Breen, D., Lin, M.
2003
- **Finite Volume Methods for the Simulation of Skeletal Muscle**
Teran, J., Blemker, S., Hing, V., Ng Thow, Fedkiw, R.
edited by Breen, D., Lin, M.
2003
- **The Ghost Fluid Method for Viscous Flows** *Innovative Methods for Numerical Solutions of Partial Differential Equations*
Fedkiw, R., Liu, X., D.
edited by Hafez, M., Chattot, J., J.
World Scientific Publishing, New Jersey.2002: 111–143
- **A Second Order Accurate Symmetric Discretization of the Poisson Equation on Irregular Domains** *J. Comput. Phys.*
Gibou, F., Fedkiw, R.
2002; 176: 205-227
- **A Fully Conservative Ghost Fluid Method & Stiff Detonation Waves**
Nguyen, D., Gibou, F., Fedkiw, R.
2002
- **A General Technique for Eliminating Spurious Oscillations in Conservative Schemes for Multiphase and Multispecies Euler Equations** *Int. J. Nonlinear Sci. and Numer. Sim.*
Fedkiw, R., Liu, X., D., Osher, S.

2002; 3: 99-106

- **The Penultimate Scheme for Systems of Conservation Laws: Finite Difference ENO with Marquina's Flux Splitting** *Innovative Methods for Numerical Solutions of Partial Differential Equations*
Fedkiw, R., Merriman, B., Donat, R., Osher, S.
edited by Hafez, M., Chattot, J., J.
World Scientific Publishing, New Jersey.2002: 49–85
- **Visual Simulation of Smoke** *SIGGRAPH 2001*
Fedkiw, R., Stam, J., Jensen, H., W.
2001: 23-30
- **A Quasi-Conservative Approach to the Multiphase Euler Equations without Spurious Pressure Oscillations** *Advances in Scientific Computing*
Liu, X., D., Fedkiw, R., Osher, S.
edited by Shi, Z., C., Mu, M., Xue, W.
Science Press Beijing/New York.2001: 106–115
- **Level Set Method for Thin Film Epitaxial Growth** *J. Comput. Phys.*
Chen, S., Merriman, B., Kang, M., Caflisch, R., Ratsch, C., Cheng, L., T., Fedkiw, R.
2001; 167: 475-500
- **A Numerical Method for Two Phase Flow Consisting of Separate Compressible and Incompressible Regions** *J. Comput. Phys.*
Caiden, R., Fedkiw, R., Anderson, C.
2001; 166: 1-27
- **Level Set Methods: An Overview and Some Recent Results** *J. Comput. Phys.*
Osher, S., Fedkiw, R.
2001; 169: 463-502
- **Fast Surface Reconstruction using the Level Set Method**
Zhao, H., K., Osher, S., Fedkiw, R.
2001
- **The Ghost Fluid Method for Discontinuities and Interfaces** *Godunov Methods*
Fedkiw, R.
edited by Toro, E., F.
Kluwer, New York.2001: 309–317
- **Practical Animation of Liquids** *SIGGRAPH 2001*
Foster, N., Fedkiw, R.
2001: 15-22
- **Simplified Upwind Discretization of Systems of Hyperbolic Conservation Laws Containing Advection Equations** *J. Comput. Phys.*
Fedkiw, R., Merriman, B., Osher, S.
2000; 157: 302-326
- **A Boundary Condition Capturing Method for Poisson's Equation on Irregular Domains** *J. Comput. Phys.*
Liu, X., D., Fedkiw, R., Kang, M.
2000; 160: 151-178
- **A Boundary Condition Capturing Method for Multiphase Incompressible Flow** *J. Sci. Comput.*
Kang, M., Fedkiw, R., Liu, X., D.
2000; 15: 323-360
- **An Isobaric Fix for the Overheating Problem in Multimaterial Compressible Flows** *J. Comput. Phys.*
Fedkiw, R., Marquina, A., Merriman, B.
1999; 148: 545-578
- **A Non-Oscillatory Eulerian Approach to Interfaces in Multimaterial Flows (The Ghost Fluid Method)** *J. Comput. Phys.*
Fedkiw, R., Aslam, T.

1999; 152: 457-492

- **The Ghost Fluid Method for Deflagration and Detonation Discontinuities** *J. Comput. Phys.*
Fedkiw, R., Aslam, T., Xu, S.
1999; 154: 393-427
- **Efficient Characteristic Projection in Upwind Difference Schemes for Hyperbolic Systems (The Complementary Projection Method)** *J. Comput. Phys.*
Fedkiw, R., Merriman, B., Osher, S.
1998; 141: 22-36
- **Numerical Methods for a One-Dimensional Interface Separating Compressible and Incompressible Flows** *Barriers and Challenges in Computational Fluid Dynamics*
Fedkiw, R., Merriman, B., Osher, S.
edited by Venkatakrishnan, V., Salas, M., Chakravarthy, S.
Kluwer Academic Publishers, The Netherlands. 1998: 155-194
- **Numerical Methods for a Mixture of Thermally Perfect and/or Calorically Perfect Gaseous Species with Chemical Reactions** *J. Comput. Phys.*
Fedkiw, R., Merriman, B., Osher, S.
1997; 132: 175-190