

# Stanford

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## Ron Fedkiw

Canon Professor in the School of Engineering  
Computer Science

### CONTACT INFORMATION

- **Administrator**

Alexis Wing - Administrative Associate

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### Bio

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#### 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

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#### 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

### Orals Evaluator

Sarah Jobalia, Zhengfei Kuang

### Master's Program Advisor

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

### Doctoral Dissertation Co-Advisor (AC)

Zhengfei Kuang

### Doctoral (Program)

Yitong Deng, Haodi He, Sarah Jobalia, Kevli Li

## Publications

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### 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 Bargeil, 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
- **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
- **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.  
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- **Practical Animation of Liquids** *SIGGRAPH 2001*  
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- **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