

# JUE WANG

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## Research Interests

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- Image analysis and processing
- Mathematical modeling
- Inverse problems
- Medical imaging
- Cancer/disease detection and classification
- Machine learning
- Fluid dynamics and turbulence

## Education

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- Ph.D. in Mathematics**, University of Wisconsin - Madison 2007  
Dissertation: *On Lower Branch Exact Coherent Structures in Turbulent Shear Flows*
- B.S. in Mathematics**, Peking University (Beida), Beijing, China 2001

## Employment

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- Associate Professor**, Union College 2017 – present
- Assistant Professor**, Union College 2011 – 2017
- Visiting Assistant Professor**, Union College 2007 – 2011

## Grants

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- New York Six Academic Collaboration Grant** 2020 – 2022  
*Collaborative Partnership to Foster Liberal Arts Education and Research in Applied Mathematics*
- Union College IEF Teaching with Technology Grant** 2020 – 2021
- NSF – MRI (NSF 1919570) \$384,725** 2019 – 2022  
Co-PI  
*Acquisition of a High-speed Volumetric Particle Image Velocimetry System for Fluid Mechanics Research and Research Training in Science, Mathematics, and Engineering*
- Union College Faculty Research Grant** 2018 – 2019  
*Enabling Real-Time Volumetric 3D Ultrasound Imaging at Low Cost*
- Union College MOSH Maker Co-Curricular Activity Grant** 2018 – 2019  
*Bringing Mathematics to Life with 3D Making*
- Albany Medical Center (in-kind)** 2018 – 2019  
Co-Investigator  
*Application of Enclosure Transform Interest Point Detectors and Deep Convolutional Neural Networks in Determining Malignant vs Benign Masses on Breast Imaging*
- Union College Faculty Research Grant** 2017 – 2018  
*Cancer Classification via Convolutional Neural Networks*

<b>NIH – NIBIB (NIH 1R15EB012299–01A1)</b>	<b>\$250,000</b>	2011 – 2016
Principal Investigator		
<i>Artifact-Free Reconstruction of Medical Imaging Information</i>		
<b>Union College Internal Education Foundation Grant</b>	<b>\$10,095</b>	2016
Co-Investigator, Faculty of The MakerWeb Consortium		
<i>Acquisition of a Laser Cutter to Enhance MakerWeb Curricular Activities</i>		
<b>Union College Faculty Research Grant</b>		2010 – 2011
<i>Attenuation Compensation in Ultrasound Imaging</i>		

## Honors and Awards

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<b>Invited Speaker</b> , Data Science for Social and Environmental Justice Writing Group	2021
<b>Faculty Development Institute Incubator</b> , Union College	2020
<b>Invited Speaker</b> , Leaps of Faith: 8 Stories about Cultivating Complex Thinkers	2019
<b>Invited Leader</b> , Women in Engineering (WIE) Networking, IEEE LSC	2018
<b>NSF SIMIODE Curriculum Development in STEM Effort</b>	2018
<b>Mellon Presidential Project</b> for Global Learning Faculty Study Tour, Union College	2016
<b>Faculty Development Institute</b> for Teaching with Technology, Union College	2015
<b>NSF Travel Award</b> to Casablanca International Workshop on Mathematical Biology	2011
<b>NSF Travel Award</b> to the Workshops on Inverse Problems and Applications, MSRI	2010
<b>NSF Travel Award</b> to the Workshop on Mathematical Problems in Industry	2009
<b>First Place Poster Prize</b> in SIAM Conference on Applications of Dynamical Systems	2007
<b>AWM Travel Award</b> to SIAM Conference on Applications of Dynamical Systems	2007
<b>Excellence in Teaching Award</b> , University of Wisconsin-Madison	2006
<b>Letters and Sciences Teaching Fellow</b> , University of Wisconsin-Madison	2004
<b>Elizabeth Hirschfelder Fund Scholarship</b> , University of Wisconsin-Madison	2003
<b>Superior Teaching Assistant</b> , University of Wisconsin-Madison	2001 – 2005
<b>2nd Place Award</b> in The Mathematical Contest in Modeling (MCM), China	1999
<b>Jiuzhang Mathematical Scholarship</b> , Peking University, China	1998

## Refereed Publications

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28. Convexified coupled active contour segmentation of clues cells for assessing bacterial vaginosis with immunofluorescence microscopy (with Y. Yu), *to appear in Asilomar CSSC*, 2023.
27. Dual resolution detection and identification of circulating cancer cells from immunofluorescence microscopy (with Y. Yu), *to appear in Asilomar CSSC*, 2023.
26. Mathematics for Sustainable Humanity – Population, Climate, Energy, Economy, Policy, and Social Justice, *book chapter in the Foundations for Undergraduate Research in Mathematics (FURM), Mathematics Research for the Beginning Student, Volume 1, Springer*, 2022.

25. Automatic detection and identification of trichomonas vaginalis from fluorescence microscopy images (with Y. Yu), *BIOSTEC Volume 2: Bioimaging*, 190–197, 2022.
24. Categorization of circulating tumor cells from lung cancer with compact deep learning (with Y. Yu), *Proc. SPIE Medical Imaging: Computer-Aided Diagnosis*, 1203310, 2022.
23. A novel grid regression demodulation method for radiographic grid artifact correction (with Y. Yu), *Medical Physics*, vol. 48, no. 7, 3790–3803, 2021.
22. Coupled active contours for clue cell segmentation from fluorescence microscopy images (with Y. Yu), *BIOSTEC Volume 2: Bioimaging*, 144–151, 2021.
21. Detection of filamentous microorganisms in fluorescence microscopy images (with Y. Yu), *Proc. IEEE Eng. Med. Biol. Soc.*, 1895–1898, 2020.
20. Pandemic modeling – Ebola, COVID-19, and many more, *SIMIODE*, 7518, 2020.
19. Morphological rank-space segmentation of clumped filaments in fluorescence microscopy images (with Y. Yu), *Proc. ICCM (International Conference on Computational Methods)*, 777–786, 2019.
18. Automated enumeration and classification of bacteria in fluorescent microscopy imagery (with Y. Yu), *Proc. IEEE LSC (Life Sciences Conference)*, 57–60, 2018.
17. The next time you play HvZ, think about differential equations, *SIMIODE*, 5214, 2018.
16. Inner ear drug delivery for treating hearing loss, *SIMIODE*, 5069, 2018.
15. Differential equations and resonance – can a human singing voice shatter a wine glass? *SIMIODE*, 5051, 2018.
14. Modeling cancer growth with differential equations, *SIMIODE: Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations*, 4845, 2018.
13. Variational principle for ultrasonic artifact correction and signal segmentation (with Y. Yu), *Proc. Asilomar Conference on Signals, Systems, and Computers*, 1486–1490, 2017.
12. Enclosure transform for interest point detection from speckle imagery (with Y. Yu), *IEEE Transactions on Medical Imaging*, vol. 36, no. 3, 769–780, 2017.
11. Automatic detection of direct radiation for digital fluoroscopy optimization (with Y. Yu and S.T. Acton), *Proc. IEEE ICIP*, 3379–3383, 2016.
10. X-ray collimator shutter detection by active-rods (with Y. Yu and S.T. Acton), *Proc. IEEE ICIP*, 2350–2354, 2016.
9. Automatic contrast enhancement by variational minimax optimization (with Y. Yu), *Proc. IEEE ICIP*, 173–177, 2015.
8. The asymptotic eigenvalues of first-order spectral differentiation matrices (with F. Waleffe), *Journal of Applied Mathematics and Physics*, vol. 2, no. 5, 176–188, 2014.
7. Heel effect adaptive flat field correction of digital x-ray detectors (with Y. Yu), *Medical Physics*, vol. 40, no. 8, 081913, 2013.
6. Beam hardening-respecting flat field correction of digital x-ray detectors (with Y. Yu), *Proc. IEEE ICIP (International Conference on Image Processing)*, 2085–2088, 2012.

5. Despeckling trilateral filter (with Y. Yu and G. Dong), *Proc. IEEE IVMS (Image, Video, and Multidimensional Signal Processing)*, 42–47, 2011.
4. Backscatter-contour-attenuation joint estimation model for attenuation compensation in ultrasound imagery (with Y. Yu), *IEEE Transactions on Image Processing*, vol. 19, no. 10, 2725–2736, 2010.
3. Homogenization of the equations governing the flow between a slider and a rough spinning disk (with D. Cargill *et al.*), *MPI Workshop Report, MIIS Eprints Archive*, 2009.
2. Lower branch coherent states in shear flows: transition and control (with J. Gibson and F. Waleffe), *Physical Review Letters*, 98:204501, 2007.
1. Transition threshold and the self-sustaining process (with F. Waleffe), *IUTAM Symposium on Laminar-Turbulent Transition and Finite Amplitude Solutions*, Springer, 85–106, 2005.

## Research Conference Presentations

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*Convexified coupled active contour segmentation of chlamydia cells for assessing bacterial vaginosis with immunofluorescence microscopy*, Asilomar Conference on Signals, Systems, and Computers, October 31, 2022.

*Quaternions - Navigating in Space and inside the Human Body*, MAA Seaway Meeting, October 29, 2022.

*Automatic Detection and Identification of Trichomonas Vaginalis from Fluorescence Microscopy Images*, International Conference on Bioimaging, February 10, 2022.

*Coupled Active Contours for Clue Cell Segmentation from Fluorescence Microscopy Images*, International Conference on Bioimaging, February 12, 2021.

*Detection of Filamentous Microorganisms in Fluorescence Microscopy Images*, International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), July 20, 2020.

*Computational Analysis of the Spiral Intestine in Leucoraja Erinacea* (poster), Northeast Society for Developmental Biology Meeting, Woods Hole, MA, April 6, 2019.

*Automatic Detection of Breast Masses and Location of the Prostate*, AMS Special Session on Statistical, Variational, and Learning Techniques in Image Analysis and their Applications to Biomedical, Hyperspectral, and Other Imaging, AMS-MAA Joint Mathematics Meetings, Baltimore, MD, January 19, 2019.

*Automatic Detection of Direct Radiation for Digital Fluoroscopy Optimization* (poster), IEEE Life Sciences Conference, Montréal, Canada, October 29, 2018.

*Variational Principle for Ultrasonic Artifact Correction and Signal Segmentation*, Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, October 31, 2017.

*Detecting Breast Masses and the Location of the Prostate*, SIAM Annual Meeting, Pittsburgh, PA, July 14, 2017.

*Automatic Detection of Direct Radiation for Digital Fluoroscopy Optimization* (poster), IEEE ICIP, Phoenix, AZ, September 27, 2016.

*X-ray Collimator Shutter Detection by Active-Rods* (poster), IEEE ICIP, Phoenix, AZ, September 26, 2016.

*A Weak Form Attenuation Compensation Model for Ultrasonic Imagery*, SIAM Conference on Imaging Science, Albuquerque, NM, May 25, 2016.

*Artifact Correction in Ultrasound Images with Application in Prostate Cancer Treatment*, GE Global Research Center, Niskayuna, NY, October 22, 2015.

*Automatic Contrast Enhancement by Variational Minimax Optimization* (poster), IEEE ICIP, Québec City, Canada, September 28, 2015.

*The Asymptotic Eigenvalues of First-Order Spectral Differentiation Matrices*, 2014 International Conference on Applied and Engineering Mathematics, Shanghai, China, April 17, 2014.

*Heel Effect Adaptive Flat Field Correction of Digital X-ray Detectors*, SIAM Conference on Computational Science & Engineering, Boston, MA, February 26, 2013.

*Beam Hardening-respecting Flat Field Correction of Digital X-ray Detectors* (poster), IEEE International Conference on Image Processing (ICIP), Orlando, FL, October 2, 2012.

*Attenuation Compensation in Ultrasound Imaging*, SIAM Conference on Imaging Science (IS), Philadelphia, PA, May 20, 2012.

*3D Vascular Segmentation Using A Sequential Monte Carlo Approach*, Casablanca International Workshop on Mathematical Biology, Casablanca, Morocco, June 22, 2011.

*Despeckling Trilateral Filter*, IEEE Image, Video, and Multidimensional Signal Processing Workshop, Ithaca (IVMSP), NY, June 16, 2011.

*Blood Vessel Segmentation in Volumetric Ultrasound*, Joint Mathematics Meetings, New Orleans, LA, January 8, 2011.

*Ultrasound Image Segmentation and Attenuation Estimation*, SIAM Annual Meeting, Pittsburgh, PA, July 15, 2010.

*BCA Joint Estimation Method for Attenuation Compensation in Ultrasound Images*, SIAM Conference on Mathematics for Industry: Challenges and Frontiers, San Francisco, CA, October 9, 2009.

*Lower Branch Exact Coherent Structures in Turbulent Shear Flows*, Project NExT Young Mathematicians' Network Poster Session at the Joint Mathematics Meetings, Washington D.C., January 5, 2009.

*Minimization Problem in Image Restoration*, Union College, September 22, 2008.

*Lower Branch Exact Coherent Structures – Backbone of The Separatrix* (poster), AWM Workshop in conjunction with the SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 30, 2007.

*$R^{-1}$  Scaling of Lower Branch Coherent States in Plane Couette Flow*, SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 29, 2007.

*$R^{-1}$  Scaling of The Lower Branch Exact Coherent Structures*, APS Division of Fluid Dynamics 57th Annual Meeting, Seattle, WA, November 2004.

## Teaching Presentations

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*Minervas Large-Scale Societal and Environmental Challenges Course Presentation*, President's Council Meeting, Union College, January 21, 2021.

*Silver Linings: Stories of Innovation at Union College*, December 10, 2020.

*Engaging Students to Connect Mathematical Concepts*, Part of 8x8 Leaps of Faith: 8 Stories about Cultivating Complex Thinkers for a Messy World, Union College, April 24, 2019.

*Panel Discussion for New Faculty: Advice on Teaching and Pedagogy*, Union College, August 28, 2018; September 6, 2019; August 31, 2022.

*Big Ideas, Experiences and Takeaways*, Faculty Development and Learning Presentation, February 9, 2016.

*Read it, Calculate it, Build it: Student Learning in the 3rd Dimension*, Faculty Development and Learning Presentation, February 2, 2016.

*Committee on Teaching Panel: Adjusting to Union*, Union College, February 10, 2012.

*Abacus: History and Use*, Thurston House Seminar Talk and Discussion, Union College, April 11, 2008.

*Mathematics and Physics behind Golf Ball Dimples*, Union College, October 11, 2007.

## Professional Service

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**Reviewer**, IEEE Access

**Reviewer**, IEEE ICIP

**Reviewer**, IEEE Transactions on Medical Imaging

**Reviewer**, BMC Medical Research Methodology

**Reviewer**, Journal of Medical and Biological Engineering

**Reviewer**, Asian Journal of Mathematics and Computer Research

**Biography Writer and Data Collector**, The Association for Women in Mathematics (AWM) EvenQuads - Notable Women in Mathematics Playing Cards Project, 2022

**Judge**, SIMIODE Challenge Using Differential Equations Modeling (SCUDEM), 2020

**Program Committee and Reviewer**, The 16th Australasian Data Mining Conference, 2018

**Session Chair**, SIAM Annual Meeting, 2017

**Session Chair**, SIAM Conference on Imaging Science, 2012 & 2016

**Committee and Session Chair**, Hudson River Undergraduate Mathematics Conference XVI 2009 & XXII 2015

**Session Moderator**, Second Annual Upstate New York Undergraduate Research Conference, 2012

**Co-Organizer**, The Skidmore-Union Network (SUN) Lecture, 2012

**Committee and Session Chair**, Union College Mathematics Conference, 2011

## Mentorship / Supervision

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### **Supervising undergraduate summer research**

22 students (166 student weeks), Summers 2011-13, 2017-18, 2020-22

### **Supervising senior theses, scholars projects, and other undergrad research projects**

53 students (64 academic terms)

### **Supervising student teams to participate in the MCM/ICM**

*Meritorious Winner* (top 10%): 2008, 2009, 2010, 2014, 2015

*Honorable Mention* (top 40%): 2011, 2013

*Successful Participant*: 2012, 2016-18, 2020

### **Supervising 6 undergraduate students presenting at national conferences**

2 at National Conference on Undergraduate Research (NCUR)

4 at IEEE MIT Undergraduate Research Technology Conference

### **Co-supervising 1 undergraduate peer-reviewed journal publication**

## College Service

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Committee on Teaching and Advising (COTA), 2021 – present

Writing Board, 2021 – present

Search Committee for Director of Templeton Institute and Associate Dean for Engineering and Computer Science, 2022 FA – present

College Mentorship Program Pedagogical Partners for New Faculty, 2018–19, 2019–20, 2022–23

Panel Discussion for New Faculty, 2018, 2019, 2022

Faculty Appeals Committee (FAC), 2022 SP – present

Committee for Idol Relocation, 2022 SU – present

New Gen Ed Implementation Committee, 2021 – 2022

Interview Committee for Class Dean Search, 2022 FA

Faculty Marshal at Commencement, June 2022

Ad Hoc Tenure Committee, 2018 – 2019

Co-Chair, The President's Commission on the Status of Women, 2013 – 2015

## Departmental Service

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Mathematical/Interdisciplinary Contest in Modeling (MCM/ICM) Advisor, 2008 – present

Mathematical Association of America (MAA) Seaway Representative, 2015 – present

Transfer Coordinator, 2021 – present

Career Center Representative, 2017 – present

Committee for Establishing Financial and Actuarial Mathematics Minor, 2021 – 2022

Departmental Mentor Group, 2018 – 2022

Math Curriculum Steering Committee, 2020 – 2021  
MTH 130 Curriculum Redesign Task Force, 2019 – 2021  
Student Seminar Organizer/Co-organizer, 2008 – 2009, 2019 – 2020  
Research Seminar Organizer, 2009 – 2010, 2014 – 2015  
Admissions Liaison, 2017 – 2020  
Actuarial Advisor, 2011 – 2013  
Graduate School Advisor, 2007 – 2009

## Service to the Broader Community

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Presenting exhibitions showcasing mathematics and 3D printing at the Electric City Mini Maker Faire, 2019 & 2022  
Volunteering in the Octopus's Garden, a student-run garden for local sustainable initiatives  
Trained Resident Care Volunteer at the Joan Nicole Prince Home providing bedside care and emotional support to the terminally ill at the end of life since June 2022

## Teaching Experience (Union College)

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IMP 111: Integrated Mathematics and Physics (team-taught)  
IMP 121: Integrated Mathematics and Physics 2 (team-taught)  
MIN 203: Climate Change: Knowledge Empowers Action (team-taught)\*  
MTH 063: Mathematics of Sustainability\*  
MTH 110: Differential Calculus  
MTH 113: AP Calculus  
MTH 115: Differential Vector Calculus and Matrix Theory  
MTH 115H: Enriched Differential Vector Calculus and Matrix Theory  
MTH 117: Integral Vector Calculus  
MTH 130: Ordinary Differential Equations  
MTH 138: Methods of Applied Mathematics 1  
MTH 197: Discrete Mathematics  
MTH 234: Differential Equations  
MTH 238: Methods of Applied Mathematics  
MTH 295H/296H: Mathematics Honors Independent Project  
MTH 334: Partial Differential Equations\*  
MTH 340: Linear Algebra  
MTH 490: Independent Study  
MTH 497/498/499: Mathematics Senior Thesis  
IDM 487/488/489: Interdepartmental Senior Thesis (team-taught)

\* new courses I developed/co-developed