

Curriculum Vitae

Hui Yu

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Research Interests

- Regularity of elliptic PDEs—classical and nonlocal,
- Optimal transport,
- Free boundary problems.

Employment

- National University of Singapore Sep 2021-
Assistant Professor, NUS Presidential Young Professor
- Columbia University Aug 2017 - Aug 2021
Ritt Assistant Professor

Education

- PhD in Mathematics, May 2017.
The University of Texas at Austin.
Advisor: Luis A. Caffarelli.
- BSc in Mathematics, May 2013.
Chinese University of Hong Kong.

Awards and Grants

- NSF standard grant: DMS-1954363.
- AMS-Simons travel grant (Declined due to NSF grant).
- Silver Prize for Doctoral Thesis, New World Mathematics Award, International Congress of Chinese Mathematicians.

Publications and Preprints

1. (With X. Fernández-Real) *Generic properties in free boundary problems*, preprint.
2. (With S. Eberle) *Solutions to the nonlinear obstacle problem with compact contact sets*, preprint.
3. (With S. Eberle) *Compact contact sets of sub-quadratic solutions to the thin obstacle problem*, preprint.
4. (With M. Engelstein and X. Fernández-Real) *Graphical solutions to one-phase free boundary problems*, accepted by Crelle's Journal.
5. (With O. Savin) *Free boundary regularity in the multiple membrane problem in the plane*, to appear in Crelle's Journal.
6. (With O. Savin) *Half-space solutions with $7/2$ frequency in the thin obstacle problem*, to appear in Arch. Ration. Mech. Anal..
7. (With O. Savin) *Contact points with integer frequencies in the thin obstacle problem*, to appear in Comm. Pure and Appl. Math..
8. (With O. Savin) *On the fine regularity of the singular set in the nonlinear obstacle problem*, to appear in Nonlin. Anal..
9. (With Y. Wu) *On the fully nonlinear Alt-Phillips equation*, accepted by International Math. Research Notice.
10. (with O. Savin) *Free boundary regularity in the triple membrane problem*, accepted by Ars Inveniendi Analytica.
11. *A brief survey on the obstacle problem*, to appear in Proceedings of the 8th International Congress of Chinese Mathematicians.
12. (with O. Savin) *Regularity of the singular set in the fully nonlinear obstacle problem*, accepted by J. Euro. Math. Soc..
13. (with O. Savin) *Global $W^{2,1+\varepsilon}$ estimates for Monge-Ampère equation with natural boundary condition*, J. Math. Pures. Appl. 137 (2020), no. 9, 275-289.
14. (with O. Savin) *Regularity of optimal transport between planar convex domains*, Duke Math. J. 169 (2020), no. 7, 1305-1327.
15. (with O. Savin) *On the multiple membranes problem*, J. Funct. Anal. 277 (2019), no. 6, 1581-1602.
16. (with L. Caffarelli) *A curvature flow in the plane with a nonlocal term*, Calc. Var. Partial Differential Equations 57 (2018), no. 2, Art. 29, 8pp.
17. (with V. Millot and Y. Sire) *Minimizing fractional harmonic maps on the real line in the supercritical regime*, Discrete & Continuous Dynamical Systems-A 38(12), 2018, 6195-6214.
18. *What is a generalised mean-curvature flow?* Notices of AMS 64(6), 2017, 580-581.

19. *Motion of sets by curvature and derivative of capacity potential*, J. of Differential Equations 267 (2019), no. 1, 15-60.
20. *Unique continuation for fractional orders of elliptic equations*, Annals of PDE 3 (2017), Art. 16, 21pp.
21. *Small perturbation solutions for nonlocal elliptic equations*, Comm. in PDEs 42(1), 2017, 142-158.
22. *An optimization problem in heat conduction with minimal temperature constraint, interior heating and exterior insulation*, Calc. of Var. and PDEs 55(6), 2016, 1-15.
23. *A Dirichlet problem for nonlocal degenerate elliptic operators with interior nonlinearity*, Journal of Mathematical Analysis and Applications 448(1), 2017, 326-346.
24. *$W^{\sigma,\epsilon}$ -estimates for nonlocal elliptic equations*, Annales l'Institut Henri Poincaré (C) Analyse Non Linéaire 34(5), 2017, 1141-1153.
25. *Smooth solutions to a class of nonlocal fully nonlinear elliptic equations*, Indiana U. Math. J. 66(6), 2017, 1895-1919.
26. (with S. Aaron, Z. Conn, R. Strichartz) *Hodge-deRham theory on fractal graphs and fractals*, Comm. Pure. Appl. Anal. 13(2), 2014, 903-928.

Professional Service

- Referee: Hang Lung Math Awards, 2023.
- Review Panel: Young Researchers Grant Call, Fondazione Cariplo, 2023.
- External PhD Thesis Evaluator for Universitat de Barcelona (2022).
- External PhD Thesis Evaluator for Australian National University (2022).
- NSF Review Panel (2020)
- On the thesis committee of: Keaton Naff (Columbia).
- Journal refereeing: Annals of Math, Advances in Mathematics, Memoirs of AMS, Duke Math. J., Annals of PDE, ARMA, Comm. Pure Appl. Math., Journal of Functional Analysis, Annales l'Institut Henri Poincaré (C), JMPA, Math. Research Letters, Proceedings for AMS, Proc. of the Edinburgh Math. Soc, Analysis and PDE, Comm. in PDEs, Calc. Var. PDEs, Notices of AMS, NoDEA, Nonlinear Analysis, Journal of Differential Equations, Indiana Univ. Math. J., Ann. Acad. Sci. Fenn. Math, Nagoya Math. J.....

Conference Organization

- Workshop on Free Boundary Problems
Organizers: D. De Silva, O. Savin, N. Guillen, H. Yu
Columbia, May 2019.

- Workshop in Nonlinear PDEs
Organizers: D. De Silva, O. Savin, N. Guillen, H. Yu
Columbia, Nov 2018.

Invited Talks and Mini-courses

- Minisymposium, 10th ICIAM, Tokyo, August 2023.
- Analysis Seminar, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, July 2023.
- Analysis Seminar, Politecnico di Torino Italy, June 2023
- Conference on Free Boundary and Geometric Measure Theory, Levico, Italy, June 2023.
- Colloquium, Renmin University of China, May 2023.
- Analysis Seminar, Peking University, May 2023.
- Analysis Seminar, Beijing Normal University, May 2023.
- Analysis Seminar, Shanghai Jiaotong University, Feb 2023.
- Special Session, ICMC Summer Meetings on Differential Equations 2023 Jan 31, 2023.
- Special Session ‘Recent Developments in Geometric Measure Theory’, Joint Mathematics Meetings 2023, January 2023. (Cancelled)
- Online webinar on APDE, Nov 2022.
- Seminar at Institut Mittag-Leffler, Djursholm, Sweden, Nov 2022.
- Workshop on Regularity Theory for Free Boundary and Geometric Variational Problems, Pisa, July 2022.
- Short course, Workshop on Free Boundary Problems, ETH, July 2022.
- International Conference on PDEs and Geometric Analysis, Shanghai Jiaotong University, June, 2022.
- Analysis And PDE Seminar, BICMR, May 2022.
- Seminar on Nonlinear Analysis, Rutgers University, April 2022.
- MFO-RIMS Tandem Workshop, University of Kyoto, March 2022.
- SIAM Conference on PDE, March 2022.
- PDE Seminar, HKUST, March 2022.
- CMSA Interdisciplinary Science Seminar, Harvard, Feb. 2022.
- Learning Seminar in PDE, Center for Mathematics, University of Coimbra, Jan. 2022.

- Geometry seminar, UCSD, May 2021.
- Carledeon-Zygmund seminar, University of Chicago, April 2021.
- Special session: Geometric and functional inequalities and nonlinear PDEs, AMS eastern sectional meeting, March 2021.
- Barcelona analysis seminar, Universitat Autònoma Barcelona and Universitat de Barcelona, Mar 2021.
- Analysis seminar, University of Maryland at College Park, Mar 2021.
- Learning seminar, Rutgers, Mar 2021.
- Nonlinear analysis seminar, Rutgers, Feb 2021.
- Special session: PDEs in optimization, control and games, JMM 2021, Jan 2021.
- Seminar, National University of Singapore, Nov 2020.
- Analysis seminar, University of Minnesota, Nov 2020.
- Analysis and PDE seminar, Peking University, Nov 2020.
- Zoom PDE Seminar, ShanghaiTech University, April 2020.
- Analysis Seminar, Institute for Advanced Study, March 2020 (Canceled due to Covid-19).
- Colloquium, University of Notre Dame, Jan 2020.
- Colloquium, University of Wisconsin at Madison, Dec 2019.
- Colloquium, University of Pennsylvania, Dec 2019.
- Special session on ‘Analysis of Nonlinear Partial Differential Equations and Applications’, AMS sectional meeting, Riverside CA, Nov 2019.
- Analysis seminar, University of Pennsylvania, Sep 2019.
- Analysis seminar, University of Maryland, Sep 2019.
- Special session on ‘Fully Nonlinear Elliptic and Parabolic Partial Differential Equations, Local and Nonlocal’, AMS sectional meeting, Madison, Wisconsin, Sep 2019.
- Swedish Summer Conference on PDEs, Stockholm, Sweden, Aug 2019.
- Seminar in PDE, Hong Kong University of Science and Technology, June 2019.
- 45min Talk, International Conference of Chinese Mathematicians, June 2019.
- Special session in ‘Regularity theory of PDEs and calculus of variations on domains with rough boundaries’, AMS sectional meeting, University of Connecticut, April 2019.
- Special session in PDE and GMT, AMS sectional meeting, Hawaii, March 2019.
- CNA seminar, Carnegie Mellon University, PA, Feb 2019.

- Workshop in Nonlinear PDEs, Columbia University, Nov 2018.
- Analysis seminar, Northwestern University, October 2018.
- Analysis seminar, Courant Institute, NYU, October 2018.
- PDE/ applied math seminar, Indiana University at Bloomington, Sep 2018.
- Seminar for School of Mathematics, Southeast University, China, Aug 2018.
- Special session in PDE and GMT, AMS sectional meeting, Portland Oregon, April 2018.
- PDE seminar, Brown University, Dec 2017.
- Nonlinear analysis seminar, Rutgers, Nov 2017.
- Geometry and analysis seminar, Columbia University, Sep 2017.
- Mini-course at BNU PDE workshop and minicourses, Beijing Normal University, July 2017.
- Talk at BNU PDE workshop, Beijing Normal University, June 2017.
- Analysis seminar, the University of Texas at Austin, May 2017.
- Seminar in pure math, Hong Kong University of Science and Technology, Aug 2016.
- Pizza seminar, the University of Texas at Austin, April 2016.
- Analysis seminar, the University of Texas at Austin, March 2016.

Academic Visits

- Institut Mittag-Leffler, August-November 2022.
 Program: Geometric aspects of nonlinear partial differential equations.
 Organizers: Panagiota Daskalopoulos, Alessio Figalli, Erik Lindgren, Henrik Shahgholian and Susanna Terracini
- Courant Institute at New York University, Host: Fanghua Lin, Jan-March 2017.
- Johns Hopkins University, Host: Yannick Sire, March-April 2017.

Teaching

At NUS:

- Instructor for Mathematical Analysis I (Special Module).
- Instructor for Ordinary Differential Equations.
- Instructor for Advanced Ordinary Differential Equations.

At Columbia:

- Instructor for Intro. to Modern Analysis I, Spring 2018, Spring 2019, Spring 2020.

- Instructor for Intro. to Modern Analysis II, Fall 2017, Fall 2018, Fall 2019, Fall 2020.
At UT Austin:
- TA for Calculus, Fall 2013, 2014, 2015.
- TA for Graduate Level Probability, Fall 2016.
- TA for Undergraduate Level Real Analysis, Spring 2015.

Mentoring**Postdoc**

- Yamin Wang

Graduate students

- Runcao Lyu
- Xintong He

Undergraduate students

- Wenjun Ong, Fall 2023-Spring 2023. Topic: Ordinary Differential Equations and Dynamical Systems.
- Aiqi Liu, Fall 2022-Spring 2023. Topic: Theory of Harmonic Functions.
- Yu-Hsiang Teng, Spring 2022. Topic: Theory of Harmonic Functions.
- Runcao Lyu and Zikai Ye, Summer 2021-Spring 2022. Topic: The Thin Obstacle Problem.
- Zhenfeng Tu, Spring 2020. Topic: Minimal Surface.
- Jieyin Yang, Spring 2020. Topic: Minimal Surface.
- Christian Serio, Spring 2019. Topic: Real and Functional Analysis.
- Ayeong Lee, Fall 2018. Topic: Intro. to Hamilton-Jacobi Equations.
- Zixiang Zhang, Summer 2018. Topic: Introduction to PDEs.
- Arvind Venkat Mahankali, Summer 2018. Topic: Intro. to PDEs.
- Cody Freitag, Fall 2015. Topic: Extremal combinatorics.
- Josselyn Gonzalez, Spring 2015. Topic: Complex analysis.
- Rafael Almeida, Fall 2014. Topic: Calculus on manifolds.
- Joey Tatro, Fall 2014. Topic: Intro. to graph theory.