Alaa Haj Ali

Contact Information

Arizona State University
School of Mathematical and Statistical Sciences
Tempe, AZ 85287-1804
Office: ECA207

ahajali1@asu.edu
https://math.asu.edu/node/5088

Citizenship United States

Research Interests Partial Differential Equations, Calculus of Variation, Free Boundary Problems.

Occupation

Assistant Teaching Professor, Arizona State University **2022-present**

Postdoctoral Scholar, Arizona State University **2021-2022**

Mentor: Donatella Danielli

Golomb Visiting Assistant Professor of Mathematics, Purdue University **2019 - 2021**

Mentor: Donatella Danielli

Education

Ph.D in Mathematics, Wayne State University **May 2019**

- Dissertation Topic: Existence,Uniqueness, and Symmetry Properties of Free Boundary Problems for some Non-Linear Degenerate Elliptic Second Order Partial Differential Equations
- Advisor: Peiyong Wang

B.S. in Mathematics, University of Michigan-Dearborn **August 2012**

- Minor in computer science

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Papers

Haj Ali, A. and Wang, P., The one-phase bifurcation for the p-Laplacian, *Journal of Differential Equations*, 266 (2019), no. 4, 1899 - 1921 https://arxiv.org/abs/1801.06221

Haj Ali, A., Li, D. and Wang, P., Symmetry and approximate symmetry of a nonlinear elliptic problem over a ring, *Calculus of Variations and Partial Differential Equations* 58 (2019), no. 2, Paper No. 61, 25 pp. https://arxiv.org/abs/1711.07109

Danielli, D. and Haj Ali, A. A two phase boundary obstacle-type problem for the bi-Laplacian, *Nonlinear Analysis* 214 (2022), Paper No. 112583, 26 pp. https://arxiv.org/abs/2109.03380

Danielli, D., and Haj Ali, A., A survey on obstacle-type problems for fourth order elliptic operators, *Matemática Contemporânea* 52 (2022), 87-118. https://arxiv.org/abs/2211.09311

Charro, F., Haj Ali, A., Raihen, L., Torres, M. and Wang, P., A bifurcation phenomenon in a singularly perturbed two-phase free boundary problem of phase transition, *Nonlinear Analysis Real World Applications* 73 (2023), Paper No. 103911, 16 pp.
https://www.sciencedirect.com/science/article/abs/pii/S1468121823000810

Danielli, D., Haj Ali, A. and Petrosyan, A., The obstacle problem for a higher order fractional Laplacian, *Calculus of Variations and Partial Differential Equations* 62(2023), no. 8, Paper No. 218, 22 pp. https://arxiv.org/abs/4890742

Haj Ali, A., The-time dependent thin obstacle problem for the weighted bi-Laplacian, *submitted*.

Haj Ali, A. and Wang, P., Symmetry and approximate symmetry for a nonlinear elliptic problem associated with the p-Laplace operator, *in preparation*.

Danielli, D. and Haj Ali, A., The higher order fractional unstable obstacle problem, *in preparation*.

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Invited Presentations

Elliptic and parabolic obstacle-type problems for some fourth order operators, Continuum Mechanics Seminar: University of Nebraska-Lincoln, NE, USA. (Spring 2023)

Obstacle-type problems for some fourth order elliptic operators, Workshop on theoretical and applied aspects for non-local models, hosted by BIRS, Banff, CA (July 2022).

The-time dependent thin obstacle problem for the weighted bi-Laplacian, AWM Research Symposium, The University of Minnesota, MN, USA. (June 2022).

The obstacle problem for a higher order fractional Laplacian, Special Session on A Women in Analysis Research Network Event, AMS Spring Central Sectional Meeting, virtual meeting hosted by AMS (March 2022).

On obstacle-type problems for higher order fractional Laplacian, Postdoc Seminar Series, Arizona State University, AZ, USA. (March 2022).

A two phase boundary obstacle-type problem for the bi-Laplacian, PDE Seminar, Arizona State University, AZ, USA. (November 2021).

A penalized boundary obstacle problem for the bi-Laplacian, Special Session on Geometric and Functional Inequalities and Nonlinear PDE, AMS Spring Eastern Sectional Meeting, virtual meeting hosted by AMS. (March 2021).

A penalized boundary obstacle problem for the bi-Laplacian, PDE Seminar, Purdue University, IN, USA. (November 2020).

Symmetry and Approximate Symmetry of a Nonlinear Elliptic Problem over a Ring , PDE Seminar, Purdue University, IN, USA. (October 2019).

Radial Symmetry for the p-Laplace Operator, Special Session on Fully Nonlinear Elliptic and Parabolic PDE, AMS Fall Central Sectional Meeting, University of Wisconsin-Madison, Wisconsin, USA. (September 2019).

The One-Phase Bifurcation for the p-Laplacian, SIAM Great Lakes Section Annual Meeting, Wayne State University, Detroit, MI, USA. (April 2018).

The One-Phase Bifurcation for the p-Laplacian, Special Session on Differential Equations and Applications, AMS Spring Central Sectional Meeting,Ohio State University, Columbus, OH, USA. (March 2018).

Symmetry and approximate symmetry of a nonlinear elliptic problem over a ring, Special Session on Nonlinear Elliptic and Parabolic PDE and Their Various Applications, AMS Spring Central Sectional Meeting, Indiana University, Bloomington, IN, USA. (April 2017).

The Free Boundary Condition And Non-Degeneracy For A General Nonlinear Operator, PDE Seminar, Purdue University, West Lafayette, IN, USA. (April 2016).

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Conference Attended

Joint Mathematics Meetings, Baltimore Convention Center, Baltimore, Maryland, USA. (January 2019).

Joint Mathematics Meetings, San Diego Convention Center, San Diego, California, USA. (January 2018).

Special Session on New Developments in the Analysis of Non-local Operators, AMS Fall Central Sectional Meeting, University of St. Thomas (Minneapolis Campus), Minneapolis, MN, USA. (October 2016).

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Workshops attended

Theoretical and Applied Aspects for nonlocal Models, hosted by BIRS, Banff, Canada (July 17-22, 2022).

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Services

Co-coordinator for MAT 266: Calculus for Engineering II (Fall 2023-present).

Co-organizer of the PDE seminar at SoMSS, ASU (Fall 2021-present).

Honors Enrichment Contract Mentor on *" Application of linear algebra to images filtering, weather prediction, dynamical systems..."*, ASU (Fall 2023).

Honors Enrichment Contract Mentor on *"Advanced topics in mathematical structures"*, ASU (Summer 2023).

Honors Enrichment Contract Mentor on *"Solving and analyzing differential equation problems related to mechanical and electrical vibrations using MATLAB"*, ASU (Spring 2023).

Vounteer at the research room at *the ASU open door event*, (Spring 2023).

Co-organizer of an AWM Special Session on Recent Developments in the Analysis of Local and Non-local PDEs, JMM, John B. Hynes Veterans Memorial Convention Center, Boston, MA, USA. (January 2023).

Co-organizer of a Special Session on Elliptic and Parabolic PDEs in Complex Fluid and Free boundary Problems, AMS Fall Central Sectional Meeting, University of Texas at El Paso, El Paso, TX, USA. (September 2022).

Honors Enrichment Contract Mentor on *"Supplemental topics in Mathematical Structures"*, ASU (Spring 2022).

Referee for: *Advanced nonlinear studies, the Journal of the Australian Mathematical Society, Electronic Journal of Qualitative Theory of Differential Equations.*

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Teaching Experience

❑ **Courses Taught at Arizona State University**

MAT 343	Applied Linear Algebra	1 section	3 credits	Fall 2023
MAT 275	Modern Differential Equations	1 sections	3 credits	Fall 2023
MAT 266	Calculus for Engineers II	1 sections	3 credits	Fall 2023
MAT 343	Applied Linear Algebra (icourse)	1 section	3 credits	Fall 2023-Session A
MAT 242	Elementary Linear Algebra (icourse)	1 section	3 credits	Fall 2023-Session A

MAT 300	Mathematical Structures	1 section	3 credits	13 students	Summer 2023-Session A
MAT 343	Applied Linear Algebra (icourse)	1 section	3 credits	75 students	Summer 2023-Session A
MAT 343	Applied Linear Algebra (icourse)	1 section	3 credits	120 students	Spring 2023-Session B
MAT 342	Linear Algebra	1 section	3 credits	43 students	Spring 2023
MAT 275	Modern Differential Equations	2 sections	3 credits	75 students each	Spring 2023
MAT 598	Topic class on "Theory of elliptic partial differential equations"				Fall 2022
MAT 300	Mathematical Structures	2 sections	3 credits	36 students each	Fall 2022
MAT 300	Mathematical Structures	1 section	3 credits	20 students	Summer 2022-Session B
MAT 300	Mathematical Structures	1 section	3 credits	20 students	Summer 2022-Session A
MAT 300	Mathematical Structures	1 section	3 credits	25 students	Spring 2022
MAT 243	Discrete Math Structures	2 sections	3 credits	70 students each section	Fall 2021

❑ **Courses Taught at Purdue University**

MA 266	Ordinary Differential Equations	2 sections	3 credits	39 students each section	Spring 2021
MA 266	Ordinary Differential Equations	2 sections	3 credits	39 students each section	Fall 2020
MA 341	Foundation of Analysis	1 sections	3 credits	42 students	Summer 2020
MA 265	Linear Algebra	2 sections	3 credits	40 students each section	Spring 2020
MA 266	Ordinary Differential Equations	2 sections	3 credits	40 students each section	Fall 2019

❑ **Courses Taught at Wayne State University**

MAT	2010	Calculus 1	4 credits	36 students	Winter 2018
STA	1020	Elementary Statistics	3 credits	34 students	Fall 2017
MAT	1800	Elementary Functions (Pre-calculus)	4 credits	30 students	Winter 2017
MAT	1800	Elementary Functions (Pre-calculus)	4 credits	25 students	Winter 2016

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Awards

AWM Symposium travel grant — Summer 2022

Association for Women in Mathematics

Thomas C. Rumble University Graduate Fellowship — 2018-2019

Mathematics Department, Wayne State University

Teaching Graduate Assistance (GTA) Award — 2017-2018

Mathematics Department, Wayne State University

Graduate Assistance In Area of National Needs (GAANN) Fellowship — 2014-2017

Mathematics Department , Wayne State University

Graduate students travel grant — Spring 2017

American Mathematical Society

Zelonka Endowed Scholarship Winter 2014

Wayne State University, Department of Mathematics

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Programming Skills	C++, Excel, Mathematica, Matlab and Python
Language Skills	Arabic, English, French