

Mustafa Hajij

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Employment

May 2017-current Postdoctoral Scholar, Department of Computer Science Engineering, University of South Florida
2015-May 2017 Postdoctoral Scholar, Department of Mathematics, University of South Florida

Education

2008–2015 Louisiana State University
Ph.D. in Mathematics, Advisor: Oliver Dasbach
Dissertation title: *Knots, Skein Theory and q -Series*

2014–2015 Louisiana State University
M.S. in Computer Science, Advisor: Xin Li
Thesis title: *Constructing Desirable Scalar Fields for Morse Analysis on Meshes*

2005-2008 Jordan University for Science and Technology
M.S. in Mathematics

2001-2005 Damascus University
B.S. in Mathematics

Research Interests

Topological Data Analysis	Computational Topology	Geometric Processing	Geometric Topology	Knot Theory
Quandles	Quantum Invariants	Number Theory	Braid Groups	

Mathematics Publications

1. *Quantum Spin Networks and q -Series*, in preparation.
2. Generating sets of Reidemeister moves of oriented singular links and quandles, (Joint work with Mohamed Elhamdadi), 2017 submitted.
3. *On Rational Knots and Links in the Solid Torus*, (Joint work with Khaled Bataneh and Mohamed Elhamdadi), submitted, 2017.
4. Foundations of the Colored Jones Polynomial of singular knots, (Joint work with Mohamed Elhamdadi) Accepted to Bulletin of the Korean Mathematical Society, 2017.
5. *Singular Knots and Involution Quandles*, (Joint work with I. Churchill, M. Elhamdadi, S. Nelson), Accepted to Journal of Knot Theory and its Ramifications, 2017.
6. *Twist Regions and Coefficients Stability of the Colored Jones Polynomial*, (Join work with Mohamed Elhamdadi and Masahico Saito). Transaction of the AMS, 2016.
7. *The Colored Jones Polynomial of Singular knots*. (Joint work with Khaled Bataneh and Mohamed Elhamdadi), New York Journal of Mathematics, 2016.
8. *Pretzel Knots and q -Series*, (Joint work with Mohamed Elhamdadi), 2016. Osaka Journal of Mathematics.
9. *The colored Kauffman skein relation and the head and tail of the colored Jones polynomial*, Journal Knot Theory and its Ramifications. 2016.
10. *The tail of a quantum spin network*, The Ramanujan Journal, 2015.
11. *The Bubble skein element and applications*, Journal of Knot Theory and Its Ramifications, 2015.
12. *Jones polynomial for links in the handlebody* (Joint work with Khaled Bataneh), Rocky Mountain Journal of Mathematics, Vol. 43, No. 2, 2013.

Computer Science Publications

1. *An efficient data retrieval Reeb graph Algorithm*, in preparation.
2. *Geometry and Symmetry Aware Scalar Functions on Triangulated 2-Manifolds*, (Joint work with Xin Li), in preparation.
3. *Graph Based Analysis for Gene Segment Interactions in a Scrambled Genome*, (joint work with Natasha Jonoska, Denys Kukushkin, Masahico Saito) 2017, in preparation.
4. *Persistent Homology Guided Exploration of Time-Varying Graphs*. (Joint with Paul Rosen, Bei Wang and Carlos Scheidegger) 2017, submitted.
5. *Mapper on Images*, (Joint with Paul Rosen and Alejandro Robles), 2017, submitted.
6. *Unknotted Strand Routings of Triangulated Meshes*, (Joint work with Abdulmelik Mohammed), International Conference on DNA-Based Computers, 2017.
7. *Segmenting a Surface Mesh into Pants Using Morse Theory*, (Joint work with Tamal Dey and Xin Li), 2016. Graphical Models.

Seminars and Colloquium Talks

- University of South Florida, *An introduction to persistence homology*, (Colloquium Talk) Apr. 2017.
- University of South Florida, Tampa, *An introduction to topological data analysis*, Apr. 2017.
- University of South Florida, Tampa, *Graph based clustering algorithms*, March. 2017.
- University of South Florida, Tampa, *A pants decomposition algorithm for triangulated surfaces*, Oct. 2016.
- University of South Florida, Tampa, *Morse Theory and its applications in geometric processing*, Sep. 2016.
- University of Central Florida, Orlando, *Knots, hyperbolic geometry and q-series*, Feb. 2016.
- University of South Florida, Tampa, *Quantum invariants of knots, hyperbolic geometry and q-series*, (Colloquium Talk) Feb. 2015.
- Tulane University, New Orleans, *Quantum invariants and q-series*, (Colloquium Talk) Sep. 2014.
- University of South Florida, Tampa, *Recent development in quantum invariants*, (Colloquium Talk) Sep. 2014.
- University of Louisiana at Lafayette, *The tail of a quantum spin network*, (Colloquium Talk) Feb. 2014.
- LSU virtual Seminar, Louisiana State University, Baton Rouge, *Skein theory and q-series*, Apr. 2014.

Invited Talks

- Knots in Washington, *Twist Regions and Coefficients Stability of the Colored Jones Polynomial*, December 2016.
- AMS Sectional Meeting, Special Session on Algebraic Structures in Knot Theory, *A one variable generalization of the Kauffman and Vogel polynomial*, March 2016.
- Fall Eastern Sectional Meeting Rutgers University, Special Session on Invariants of Knots, Links and 3-Manifolds, *Pretzel Links and q-Series*, Nov 2015.
- Central Fall Sectional Meeting Loyola University Chicago, *q-Series Identities From Pretzel Links*, Oct 2015.
- Graduate Student Conference in Algebra, Geometry, and Topology, Temple University, Philadelphia, *Quantum Invariants and q-Series*, May 2015.
- Joint Mathematics Meetings, San Antonio, Texas, *Skein theory and q-series*, Jan. 2015.
- Conference on Knot Theory and Its Applications to Physics and Quantum Computing, University Of Texas at Dallas, *Some properties of the tail of the colored Jones polynomial*, Jan. 2015.
- The Thin Manifold, University of Iowa, Iowa City, *Skein Theory and q-Series*, Aug. 2014.
- AMS Sectional Meeting, AMS Special Session on Geometric Topology and Number Theory, University of Tennessee, Knoxville, *The tail of quantum spin networks and Andrews-Gordon identities*, Mar. 2014.
- AMS Sectional Meeting, AMS Special Session on Geometric Topology, University of Tennessee, Knoxville, *The colored Kauffman skein relation and the tail of the colored Jones polynomial*, Mar. 2014.
- Knots in Washington, George Washington University, *The colored Kauffman skein relation and the tail of the colored Jones polynomial*, Jan. 2014.
- Special Session on Algebraic Structures Motivated by Knot Theory AMS-MAA Joint Mathematics Meetings, Baltimore, MD, *Skein theory and Andrews-Gordon identities for the false theta functions*, Jan. 2014.
- AMS Sectional Meeting, AMS Special Session, Fall Central Sectional Meeting Washington University, St. Louis, *Andrews-Gordon identities via the tail of the colored Jones polynomial*, Oct. 2013.
- AMS Sectional Meeting, AMS Special Session, Temple University, Philadelphia, *The tail of a quantum spin network and Andrews-Gordon identities*, Oct. 2013.

Advising

Graduate Students

- Brittany Schaum, current student.

Undergraduate

- Alejandro Robles, Mapper on Images, the 13th International Joint Conference on Computer Vision, 2017.
- Jennifer Cuartas, Polynomial Invariants in Knot Theory, Honor Thesis 2017.
- William Youmans, Generating sets of Reidemeister moves of oriented singular links and quandles, 2017

Popularizing Mathematics

- I have started a project to help making topology fun and easy to learn. I use various graphics and programming utilities, like Autodesk Maya, C++ and OpenGL, to make videos that explain mathematical ideas and concepts. My personal page on Youtube for this project is <http://www.youtube.com/mhajj1/>
- I have created a math blog on my website <http://www.mustafahajj.com/index.php/topology-blog/>

Awards

- Dean's scholarship award winner at the LSU digital media festival for the topology video "[Turaev surfaces](#)", 2010.

Departmental Talks

- Discrete Seminars, USF, *Morse Theory and its applications in geometric processing*, Sep. 2016.
- Discrete Seminars, USF, *Knots and 3-Manifolds*, Oct 2015.
- Topology Seminars, USF, *An introduction to the colored Jones polynomial*, Sep 2015.
- Topology Seminars, USF, *The Jones-Wenzel projector*, Sep 2015.
- Topology Seminars, USF, *An introduction to the Kauffman Bracket Skein Modules*, Aug 2015.
- Computational Geometry Seminar, LSU, *Manifold Harmonics*, March 2015.
- Computational Geometry Seminar, LSU, *Reeb graph and surface parametrization*, Feb 2015.
- VIGRE Algebra Seminar, LSU, *Young tableau*, Jan, 2015
- Computational Geometry Seminar, LSU, *An algorithm for pants decomposition*, Sep 2014.
- Junior Topology Seminar, LSU, *A History of the Jones polynomial*, Apr. 2014.
- Computational Geometry Seminar, LSU, *Morse Smale complex*, Mar 2014.
- Junior Topology Seminar, LSU, *The Alexander polynomial*, Mar 2014.
- Junior Topology Seminar, LSU, *The head and the tail of the colored Jones polynomial*, Feb 2014.
- VIGRE Topology Seminar, LSU, *KCH representations*, Feb 2014.
- VIGRE Topology Seminar, LSU, *Artin representations*, Feb. 2014
- VIGRE Algebra Seminar, LSU, *Skein theory and 6j-symbols*, Nov. 2013.
- Computational Geometry Seminar, LSU, *An algorithm for Betti numbers of simplicial complexes in the 3-sphere*, Nov. 2013.
- Computational Geometry Seminar, LSU, *Morse theory and 3-manifolds*, Oct. 2013.
- VIGRE Topology Seminar, LSU, *Calculating the colored Jones polynomial using skein theory*, Oct. 2013
- VIGRE Topology Seminar, LSU, *Quantum spin networks*, Oct. 2013.
- VIGRE Algebra Seminar, LSU, *The Quantum enveloping algebra of sl_2* , Sep. 2013.
- VIGRE Topology Seminar, LSU, *Quantum invariants*, Sep. 2013.
- Topology Research Seminar, LSU, *The tail of a quantum spin network*, Aug. 2013.
- Topology Seminar, LSU, *Quantum and classical Temperley-Lieb algebras*, Apr. 2013.
- Topology Seminar, LSU, *The quantum 6j-symbols*, Apr. 2013.
- Topology Seminar, LSU, *Burau representation from $Uq(sl_2)$* , Jan. 2013.
- VIGRE Topology Seminar, LSU, *Representations of finite groups*, Feb. 2012.
- Topology Seminar, LSU, *Frobenius algebras and 2D topological quantum field theories*, Nov. 2012.
- Topology Seminar, LSU, *The colored Jones polynomial*, Nov. 2012.
- Topology Seminar, LSU, *Mathematical billiards*, Dec. 2012.
- Analysis Seminar, LSU, *$SU(2)$ and $SO(3)$ representations*, May 2011.
- Topology Seminar, LSU, *H-Spaces and Hopf algebras*, Apr. 2011.
- Topology Seminar, LSU, *Hecke algebra representation of braid groups and links*, Apr. 2010.
- Topology Seminar, LSU, *Orientation on manifolds*, Apr. 2010.
- Graduate Seminar, JUST, *Jones polynomial for oriented links in the solid torus*, Dec 2007
- Graduate Seminar, JUST, *Aicardi's invariant for knots in the solid torus*, Nov 2006

Teaching Experience

At University of South Florida:

- Calculus III, Spring 2017.
- Applied Topology and Data Analysis, Fall 2016.
- Business Calculus, Summer 2016.
- Geometric Processing Algorithms, Spring 2016.
- Linear Algebra, instructor, Fall 2015.

At Louisiana State University

- Calculus I, instructor, Spring 2015.
- College Algebra and Trig, instructor, Fall 2014.
- Calculus I, instructor, Summer 2014.
- Calculus II, instructor, Spring 2014.
- College Algebra and Trig, instructor, Fall 2013.
- Calculus II, instructor, Summer 2013.
- Calculus II, teaching assistant, Spring 2013.
- Calculus II, instructor, Fall 2012.
- Calculus II, instructor, Spring 2012.
- College Algebra and Trig (2 sections), instructor, Fall 2011.
- Calculus II, instructor, Spring 2010.
- Calculus I, instructor, Fall 2010.

- College Algebra, instructor, Spring 2009.

Course Design Experience

- Applied Topology and Data Analysis : designing a new syllabus for the course material.
- Geometric processing algorithms: designing a new syllabus for the course material.

Services

Professional-Peer Review

- Proceedings of the American Mathematical Society
- New York Journal of Mathematics
- Transactions of Visualization and Computer Graphics
- Graphics Models

Academic

- Fall 2011 — 2015 *Coordinator of the LSU student Colloquium Committee.*
- Spring 2014 *Organizer of the Junior Topology Seminar at Louisiana State University.*
- 2012-2013 *Member and Presenter in the GEAUX Mathematics Graduate Orientation.*
- 2011-2012 *Organizer of the Junior Topology Seminar at Louisiana State University.*

References

Oliver Dasbach, Louisiana State University, Department of Mathematics, kasten@math.lsu.edu

Konstantin Busch, Louisiana State University, Department of Computer Science, busch@csc.lsu.edu

Mohamed Elhamedi, University of South Florida, Department of Mathematics, emohamed@usf.edu

Patrick Gilmer, Louisiana State University, Department of Mathematics, gilmer@math.lsu.edu

Effie Kalfagianni, Michigan State University, Department of Mathematics, kalfagia@math.msu.edu

Masahiko Saito, University of South Florida, Department of Mathematics, saito@usf.edu

Robert Osburn, University College Dublin, Department of Mathematics, robert.osburn@ucd.ie

Paul Rosen, University of South Florida, Department of Computer Science, prosen@usf.edu

James Oxley (teaching), Louisiana State University, Department of Mathematics, oxley@math.lsu.edu

Bei Wang, University of Utah, Scientific Computing and Imaging Institute, beiwang@sci.utah.edu