

# Mustafa Hajij

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Department of Mathematics  
University of South Florida  
Tampa, Florida

[mhajij@usf.edu](mailto:mhajij@usf.edu)  
<http://math.usf.edu/faculty/mhajij/>

## Employment

2015-present Postdoctoral Scholar, 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

Knot Theory	Geometric Topology	Quantum Invariants	Skein Theory
Braid Groups	Computational Topology	Geometric Processing	Number Theory

## Papers

1. *Product structures on the tail of the colored Jones polynomial*, (Joint work with Oliver Dasbach), in preparation.
2. *A one variable generalization of the Kauffman-Vogel polynomial*. (Joint work with Mohammad Elhamdidi) in preparation.
3. *Segmenting a Surface Mesh into Pants Using Morse Theory*, (Joint work with Tamal Dey and Xin Li), submitted.
4. *Pretzel Knots and  $q$ -Series*, (Joint work with Mohammad Elhamdidi), submitted.
5. *The colored Kauffman skein relation and the head and tail of the colored Jones polynomial*, arXiv:1401.4537. 2014.
6. *The tail of a quantum spin network*, The Ramanujan Journal, 2015.
7. *The Bubble skein element and applications*, Journal of Knot Theory and Its Ramifications, 2015.
8. *Jones polynomial for links in the handlebody* (Joint work with Khaled Bataineh), Rocky Mountain Journal of Mathematics, Vol. 43, No. 2, 2013.

## Seminars and Colloquium Talks

- 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

- 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.

### 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/>

### Awards and Grants

- AMS traveling grant recipient, 02/2014, 10/2014, 01/2015.
- Tulane University traveling award grant recipient, 09/2014
- University of South Florida traveling award grant recipient, 09/2014
- University of Iowa traveling award grant recipient, 07/2014.
- Louisiana State University Graduate student traveling award, 07/2009, 10/2013 and 08/2014.
- George Washington University travel grant recipient. 08/2011, 01/2014.
- Dean's scholarship award winner at the LSU digital media festival for the topology video "[Turaev surfaces](#)", 2010.

### Conference Attendance

- Nov 2015, Fall Eastern Sectional Meeting Rutgers University, NJ.
- Oct 2015, Central Fall Sectional Meeting, Loyola University, Chicago.
- May 2015, Graduate Student Conference in Algebra, Geometry, and Topology, Temple University, Philadelphia.
- Jan. 2015, AMS Special Session on Knot Theory, Joint Mathematics Meetings, San Antonio.
- Jan. 2015, Conference on Knot Theory and Its Applications to Physics and Quantum Computing, University of Texas at Dallas, Richardson.
- Aug. 2014, The Thin Manifold, University of Iowa, Iowa City.
- May 2014, GEAR Junior Retreat, University of Michigan at Ann Arbor.
- Apr. 2014, Graduate Student Topology and Geometry Conference, University of Texas at Austin.
- Mar. 2014, AMS Special Session on Geometric Topology and Number Theory, University of Tennessee, Knoxville.
- Jan. 2014, Knots in Washington, George Washington University.
- Jan. 2014, AMS Special Session on Algebraic Structures Motivated by Knot Theory AMS-MAA Joint Mathematics Meetings, Baltimore, MD.
- Feb. 2014, Lloyed Roeling UL Lafayette Mathematics Conference, University of Louisiana at Lafayette.
- Oct. 2013, AMS Special Session on Geometric Aspects of 3-Manifold Invariants, Fall Central Sectional Meeting, Washington University, St. Louis.
- Oct. 2013, AMS Special Session on Geometric Topology of Knots and 3-Manifolds, Temple University, Philadelphia.
- June 2012, Moab Topology Conference, Moab, Utah.
- Oct. 2012, AMS Fall Southeastern Sectional Meeting, AMS Special Session on Combinatorial Methods in Knot Theory, Tulane University.
- May 2011, Knots in Washington, George Washington University.
- Jan. 2011, Joint Mathematics Meetings, New Orleans, LA.
- May. 2010, Knots in Washington, George Washington University.
- Nov. 2009, First National Forum for Young Topologists, Tulane University, New Orleans, LA.
- June 2009, On the Volume Conjecture: Interactions Between Hyperbolic Geometry, Quantum Topology and Number Theory, Columbia University.

### Departmental Talks

- 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.
- Junior Topology Seminar, LSU, *Quantum and classical Temperley-Lieb algebras*, Apr. 2013.
- Junior Topology Seminar, LSU, *The quantum 6j-symbols*, Apr. 2013.
- Junior Topology Seminar, LSU, *Burau representation from  $Uq(sl_2)$* , Jan. 2013.
- VIGRE Topology Seminar, LSU, *Representations of finite groups*, Feb. 2012.
- Junior Topology Seminar, LSU, *Frobenius algebras and 2D topological quantum field theories*, Nov. 2012.
- Junior Topology Seminar, LSU, *The colored Jones polynomial*, Nov. 2012.
- Junior Topology Seminar, LSU, *Mathematical billiards*, Dec. 2012.
- Junior Analysis Seminar, LSU,  *$SU(2)$  and  $SO(3)$  representations*, May 2011.
- Junior Topology Seminar, LSU, *H-Spaces and Hopf algebras*, Apr. 2011.
- Junior Topology Seminar, LSU, *Hecke algebra representation of braid groups and links*, Apr. 2010.
- Junior Topology Seminar, LSU, *Orientation on manifolds*, Apr. 2010.
- Graduate Students Seminar, JUST, *Jones polynomial for oriented links in the solid torus*, Dec 2007
- Graduate Students Seminar, JUST, *Aicardi's invariant for knots in the solid torus*, Nov 2006

## Teaching Experience

At University of South Florida:

- Applied Topology and Data Analysis, Fall 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.

## Computer Work 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.
- Summer 2015 at LSU Geometric and Visual Computing (GVC) Lab: Developing multiple algorithms in the computational geometry lab at LSU.

## Computer Skills and Experience

- 4 years of experience in C++.
- Experience with OpenGL.
- Experience with Autodesk Maya.

- Experience in Mathematica.
- Experience in Python

## Services

- 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 (dissertation advisor), Louisiana State University, Department of Mathematics, [kasten@math.lsu.edu](mailto:kasten@math.lsu.edu)

Konstantin Busch, Louisiana State University, Department of Computer Science, [busch@csc.lsu.edu](mailto:busch@csc.lsu.edu)

Mohamed Elhamedi, University of South Florida, Department of Mathematics, [emohamed@usf.edu](mailto:emohamed@usf.edu)

Patrick Gilmer, Louisiana State University, Department of Mathematics, [gilmer@math.lsu.edu](mailto:gilmer@math.lsu.edu)

Effie Kalfagianni, Michigan State University, Department of Mathematics, [kalfagia@math.msu.edu](mailto:kalfagia@math.msu.edu)

Xin Li, Louisiana State University, Department of Computer Science, [xinli@cct.lsu.edu](mailto:xinli@cct.lsu.edu)

Masahiko Saito, University of South Florida, Department of Mathematics, [saito@usf.edu](mailto:saito@usf.edu)

Robert Osburn, University College Dublin, Department of Mathematics, [robert.osburn@ucd.ie](mailto:robert.osburn@ucd.ie)

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