# Brody Dylan Johnson

Department of Mathematics and Statistics
Saint Louis University, 220 N. Grand Blvd., Saint Louis, Missouri 63103
brody.johnson at slu dot edu    https://mathstat.slu.edu/~johnson

## PERSONAL INFORMATION

Born July 6, 1973, Battle Creek, Michigan, USA.

## EDUCATION

Ph.D.     *Mathematics,* Washington University in Saint Louis, May 2002.
Dissertation: *Wavelets: generalized quasi-affine and oversampled-affine frames.*
Chairman: Guido L. Weiss.

A.M.     *Mathematics,* Washington University in Saint Louis, May 1999.

M.S.     *Mechanical Engineering,* Virginia Polytechnic Institute and State University, August 1997.
Thesis Title: *Control of broadband acoustic radiation from structures using a piezoelectric double-amplifier active-skin.*

B.S.     *Mechanical Engineering,* Virginia Polytechnic Institute and State University, May 1996, *Summa Cum Laude,* Minor: *Mathematics.*

Attended:  Hagerstown Community College, Hagerstown, Maryland.
Southern Illinois University at Edwardsville, Edwardsville, Illinois.

## PROFESSIONAL EXPERIENCE

2003–     Saint Louis University, Saint Louis, Missouri.
*Professor*, Department of Mathematics and Statistics (2024–).
*Associate Professor*, Department of Mathematics and Statistics (2009–2024).
*Associate Chair*, Department of Mathematics and Statistics (2016–2021).
*Assistant Professor*, Department of Mathematics and Computer Science (2003–2009).

2002–2003  Georgia Institute of Technology, Atlanta, Georgia.
VIGRE *Visiting Assistant Professor*, School of Mathematics.

## HONORS AND AWARDS

- Student Atheletes Straight-A Luncheon Invitee (2016, 2018, 2022, 2024)

- SIMIODE DEMARC Fellow (2021)

- SGA Faculty Excellence Award (2005, 2006, 2012)

- Award for Outstanding Service to Undergraduate Students (2009)

- William V. Stauder, S.J. Award for Excellence in Teaching in the Natural Sciences (2008)

- SLU Summer Research Award (2006)

# Brody Dylan Johnson

## Work in Progress

- *Stable, Nonseparable Filters for the Two-Dimensional Á Trous Algorithm with the Quincunx Dilation* (with Simon McCreary-Ellis), submitted, (2024).

- *Declipping and the recovery of vectors from saturated measurements* (with Wedad Alharbi, Daniel Freeman, Dorsa Ghoreishi, and N. Lovosoa Randrianarivony), submitted, (2024).

## Publications in Mathematics

16. *Stability of the À Trous Algorithm Under Iteration* (with Simon McCreary-Ellis), Int. J. Wavelets Multiresolut. Inf. Process., **22**(5) (2024). `https:///dx.doi.org/10.1142/S0219691324500164`

15. *Pull-Back Cars: Vehicles for the Instruction of Differential Equations* (with Tova Brown), College Math. J., **55**(3) (2024), 192–204. `https://doi.org/10.1080/07468342.2024.2302300`

14. *Dynamical Dual Frames, Annihilating Polynomials, and Spectral Radius* (with Jonathan Ashbrock, Rocio Diaz Martin, Ivan Medri, and Alexander M. Powell), Special Issue on Harmonic Analysis, Image Processing and Integral Transforms (In honor of the 65th birthday of Professor Akram Aldroubi), Poincare J. Anal. Appl., Vol. 10(2), Special Issue, (2023), 27–53. `https:///dx.doi.org/10.46753/pjaa.2023.v010i03.003`

13. *Stability of Iterated Dyadic Filter Banks* (with Marcin Bownik and Simon McCreary-Ellis), Appl. Comput. Harmon. Anal., **64**(2023), 229–253. `https://doi.org/10.1016/j.acha.2023.01.006`

12. *Sparse recovery using the Discrete Cosine Transform* (with Benjamin Barros), "A Celebration of Guido L. Weiss for his Ninetieth Birthday", J. Geom. Anal. (2021). `https://doi.org/10.1007/s12220-020-00574-0`

11. *Intrinsic four-point properties* (with Edward Andalafte, Raymond Freese, and Rebecca Lelko), J. Geom., **105**(1) (2014), 1–11.

10. *Quincunx wavelets on $\mathbb{T}^2$* (with Kenneth R. Hoover), "Wavelets and Multiscale Analysis: Theory and Applicatons," Appl. Numer. Harmon. Anal., Birkh auser/Springer, New York, 2011.

9. *A finite dimensional approach to wavelet systems on the circle,* Glasnik Matematicki, Glasnik Matematicki, **46**(2) (2011), 415–431.

8. *Frame potential and finite abelian groups* (with Kasso A. Okoudjou) "Radon transforms, geometry, and wavelets," Contemp. Math., **464** (2008), 137–148.

7. *Stable filtering schemes with rational dilations*, J. Fourier Anal. Appl., **13**(5) (2007), 607–621.

6. *Orthogonal wavelet frames and the vector-valued wavelet transform* (with Ghanshyam Bhatt and Eric Weber) Appl. Comput. Harmon. Anal., **23**(2) (2007), 215–234.

5. *The nonholonomy of the rolling sphere*, Amer. Math. Monthly, **114**(6) (2007), 500–508.

4. *Convolutional frames and the frame potential* (with Matthew Fickus, Keri Kornelson, and Kasso A. Okoudjou) Appl. Comput. Harmon. Anal., **19**(1) (2005), 77–91.

3. *Co-affine systems in $\mathbb{R}^d$*, "Wavelets, frames and operator theory," Contemp. Math., **345** (2004), 193–202.

2. *On the oversampling of affine wavelet frames*, SIAM J. Math. Anal., **35**(3) (2003), 623–638.

1. *On the relationship between quasi-affine systems and the à trous algorithm*, Collect. Math., **53**(2) (2002), 187–210.

## Publications in Engineering

2. *Broadband control of plate radiation using a piezoelectric, double amplifier active skin and structural acoustic sensing*, (with Chris R. Fuller) J. Acoust. Soc. Am., **107**(2) (2000), 876–884.

1. *A broadband passive-active sound absorption system*, (with Jerome P. Smith and Ricardo A. Burdisso) J. Acoust. Soc. Am., **106**(5) (1999), 2646–2652.

## SIMIODE Modeling Scenarios

Modeling Scenarios are pedagogical tools designed to facilitate the teaching of differential equations, many of which incorporate hands-on activities or use real data. `https://www.simiode.org/`

6. *Hands-On Modeling with Pull-Back Cars*, "3-103-S-PullBackCars-ModelingScenario" (2023). `http://dx.doi.org/10.25334/TT50-1930`

5. *Ripcord-Powered Toys: Modeling Rolling with Slipping*, "3-100-S-Ripcord-Toys-ModelingScenario" (2022). `http://dx.doi.org/10.25334/KPHH-KC97`

4. *Modeling the Deflection of a Cantilever Beam*, "9-125-S-BeamModeling" (2021). `http://dx.doi.org/10.25334/N99S-BS23`

3. *Modeling the Velocity of a Pull-Back Toy*, "3-099-S-PullBack," (2021). `http://dx.doi.org/10.25334/4C59-Q293`

2. *Gender Demographics in Engineering* (with Elodie Pozzi), "1-100-S-EngineeringDemographics," (2021). `http://dx.doi.org/10.25334/KDQV-0T66`

1. *Measuring the Quality of Insulated Water Bottles* (with Elodie Pozzi), "1-142-S-WaterBottles," (2021). `http://dx.doi.org/10.25334/5HB5-2287`

## Graduate Students

- Wedad Alharbi, Ph.D., *The Recovery of Signals from Saturated Linear Measurements*, expected Summer 2024. (co-advised with Daniel Freeman)
- Simon McCreary-Ellis, Ph.D., *Stability of the À Trous Algorithm Under Iteration*, May 2024.
- Christian Verghese, S.J., M.A., *Survey of Deterministic and Probabilistic Methods in Compressive Sensing*, August 2020.
- Benjamin Barros, M.A., *A survey of compressive sensing and sparse recovery*, August 2018.
- Elizabeth Scofidio, M.A., *Compartmental models for disease transmission with migration*, May 2017.
- Gerrit Smith, M.A., *Rationally sampled filter banks*, May 2013.
- Shasta Shakya, M.A., *Stochastic processes and applications to finance*, May 2013.
- Stephanie Thomas, M.A., *Approximate Schauder frames for $\mathbb{R}^n$*, May 2012.
- Douglas Runge, M.A., *Biorthogonal wavelet systems on the torus*, May 2009.

## SERVICE

- Faculty Mentor, Missouri Collegiate Mathematics Competition, 2015–2019, 2021, 2023–2024. (No competition was held in 2020.)

  http://sections.maa.org/missouri/contest.html

- Faculty Advisor, Mathematical Competition in Modeling, 2011–2021.

  https://www.comap.com/contests/mcm-icm

- Math Alliance F-GAP Facilitator (https://www.mathalliance.org/)

  - 2021: Silas Wallace (St. John's University)
  - 2020: Kevin Del Real Ramos (University of California – Riverside)
  - 2019: Eva-Christin Schwesig (University of California – Riverside)

- Marshal, College of Arts & Sciences Precommencement Ceremony (2008–2021)

- Local Organizer, Illinois-Missouri Applied Harmonic Analysis Seminar (2009)

- External Dissertation Committee Member, Washington University in St. Louis

  - Prasada Vegulla, Aaron Wiechmann, Jeffrey Blanchard, Lina Lee (2007)
  - WangQ Lim, David Opéla (2006)
  - Saida Sultanic (2005)

- Referee:

  - Advances in Operator Theory
  - American Mathematical Monthly
  - Analysis and Applications
  - Applied and Computational Harmonic Analysis
  - Constructive Approximation
  - Contemporary Mathematics
  - Demonstratio Mathematica
  - IEEE Transactions on Image Processing
  - IEEE Transactions on Signal Processing
  - International Journal of Wavelets, Multiresolution, and Information Processing
  - Journal of Applied Mathematics and Physics (ZAMP)
  - Journal of Fourier Analysis and Applications
  - Journal of Mathematical Imaging and Vision
  - Notices of the American Mathematical Society
  - Proceedings of the American Mathematical Society
  - Rocky Mountain Journal of Mathematics
  - Rose-Hulman Undergraduate Math Journal
  - Sampling Theory in Signal and Image Processing
  - The Physics Teacher

# Brody Dylan Johnson

TEACHING EXPERIENCE (at Saint Louis University)

Most courses are listed in the format: Term × Number of Students.

- CSCI 1060 Scientific Programming: F05×7, S07×21, F07×17, S08×25, S08×23, S09×15, S13×23.
- STAT 1300 Elementary Statistics with Computers: Su13×8.
- MATH 1400 Precalculus: S09×18.
- MATH 1510 Calculus I: F03×26, F09×24, F13×28, F14×26, F15×27, S23×48.
- MATH 1520 Calculus II: S04×22, S05×27, S10×21, S14×28, S15×30, F22×30.
- MATH 1660 Discrete Mathematics: S16×25.
- MATH 2530 Calculus III: F03×27, F04×25, F11×20, S17×20, F17×30, F19×31, F20×29, S21×26, F21×30, F23×31.
- MATH 2980 Independent Study: Introduction to Fourier Analysis (S05 2 credits).
- MATH 3110 Linear Algebra for Engineers: F21×17.
- STAT 3980 Independent Study: Topics in Probability and Statistics (Su22 2 credits).
- MATH 3240 Numerical Analysis: S12×11, S16×15.
- MATH 3550 Differential Equations: S04×26, S05×26, F06×10, Su08×12, F08×21, Su09×7, Su10×13, S11×29, Su11×20, S12×25, Su14×21, F14×31, Su15×15, F17×29, S20×36, S21×30, S23×28.
- MATH 4210 Introduction to Analysis: F05×11, Su15×1.
- MATH 4220 Metric Spaces: S06×10.
- MATH 4230 Multivariable Analysis: S11×8.
- MATH 4310 Introduction to Complex Variables: F16×7.
- MATH 4550 Nonlinear Dynamics and Chaos Theory: S14×25, S15×15, S18×14, S24×13.
- MATH 4570 Partial Differential Equations: F04×10, F05×10, F07×12, F08×9, F09×17, F11×28, F12×23, F13×26, F15×22, F16×20, F19×24, F22×16.
- MATH 4930 Special Topics: S06×11 (Signal & Image Processing), Senior Capstone: S19×4 (Compressive Sensing).
- MATH 4980 Advanced Independent Study: Finite Element Method (S06 1 credit, F08 1 credit, S14 1 credit), Wavelets in Signal Processing (F06 1 credit), Introduction to Stochastic Processes: (S07 1 credit), Analytical Dynamics: (S10 1 credit), Stochastic Calculus (S16 1 credit), Topics in Complex Analysis (S17 1 credit).
- MATH 5210 Measure Theory: F06×6, F09×5, F12×5, F18×14, F23×10.
- MATH 522 Real Analysis II (obsolete): S07×4.
- MATH 5220 Complex Analysis: S10×5, S13×5, S24×6.
- MATH 5230 Functional Analysis: S19×9.
- MATH 5980 Graduate Reading Course: Introduction to Harmonic Analysis: (F06 3 credits, F21 3 credits), Wavelet Theory: (S08 3 credits, S09 3 credits), Shift-Invariant Spaces: (F08 3 credits), Stochastic Processes: (S12 3 credits), Functional Analysis (F20 3 credits).
- MATH 6280 Topics in Analysis: S08×$4\frac{1}{2}$ (Spectral Theory).

## Conference/Seminar Presentations

38. *Compressive Sensing and the Discrete Cosine Transform*, April 2024, MAA Missouri Section Meeting, William Jewell College, Liberty, Missouri.

37. *Stability of Iterated Filter Banks*, May 2023, International Conference on Approximation Theory and Beyond, Vanderbilt University, Nashville, Tennessee.

36. *Pull-Back Cars: Vehicles for a First Modeling Experience in Differential Equations*, March 2023, MAA Missouri Section Meeting, Missouri State University, Springfield, Missouri.

35. *Pull-Back Toys and Pop Cycles: Vehicles for a First Modeling Experience*, February 2023, SIMIODE EXPO 2023 Virtual Conference. (25 min. talk, joint with Tova Brown of Wisconsin Lutheran College)

34. *Frame Bounds of Iterated Filter Banks*, April 2022, Analysis Seminar, University of Oregon, Eugene, Oregon. (1 hour)

33. *Modeling the Velocity of a Pullback Toy*, February 2022, SIMIODE EXPO 2022 Virtual Conference. (45 min. workshop, joint with Tova Brown of Wisconsin Lutheran College)

32. *Frame properties of iterated filter banks*, October 2013, Sunday Workshop connected with the AMS Special Session on Wavelets, Frames, and Related Expansions, Fall Central Sectional Meeting of the AMS, Washington University, October 2013. (30 min.)

31. *The Physics of Bowling: How Good Bowlers Stay off the Straight and Narrow*, April 2012, Math Club, Webster University, St. Louis, Missouri. (1 hour)

30. *The hat problem*, November 2010, Math Club, Mary Baldwin College, Staunton, Virginia. (1 hour)

29. *A finite-dimensional approach to periodic wavelets*, November 2010, Seminar, Norbert Wiener Center, University of Maryland - College Park, College Park, Maryland. (1 hour)

28. *A Mathematical Glance at Zombie Infestation*, October 2010, Undergraduate Seminar, University of Oregon, Eugene, Oregon. (1 hour)

27. *An introduction to filterbank frames*, October 2010, Analysis Seminar, University of Oregon, Eugene, Oregon. (1 hour)

26. *An Introduction to Frame Theory*, October 2010, Fort Lewis College, Durango, Colorado. (1 hour)

25. *Quincunx wavelets on $\mathbb{T}^2$*, December 2009, Wavelet Seminar, Washington University, St. Louis, Missouri. (1 hour)

24. *Another look at periodic wavelets*, May 2009, 20 Years of Wavelets, DePaul University, Chicago, Illinois. (25 min.)

23. *Wavelets on the torus*, April 2009, Computational Analysis Seminar, Vanderbilt University, Nashville, Tennessee. (1 hour)

22. *What is Chaos?*, April 2008, Mathematics Teacher Circle, Washington University, Saint Louis, Missouri.

21. *Frame potential and finite abelian groups*, March 2008, Spring Southeastern Sectional Meeting of the AMS, Special Session on Wavelets, Frames, and Multi-Scale Constructions, Louisiana State University, Baton Rouge, Louisiana. (20 min.)

20. *Characterizations of finite-dimensional tight frames*, November 2007, Analysis Seminar, Iowa State University, Ames, Iowa. (1 hour)

19. *Sampling and upsampling operators in finite abelian group algebras*, September 2007, Wavelet Seminar, Washington University, St. Louis, Missouri. (1 hour)

18. *Stable filtering schemes with rational dilations*,

   - May 2007, 31st SIAM Southeastern-Atlantic Section Meeting, The University of Memphis, Memphis, Tennessee. (20 min.)
   - April 2007, 2nd Illinois/Missouri Applied Harmonic Analysis Meeting, Washington University in St. Louis, St. Louis, Missouri. (40 min.)

17. *Frame decompositions of PSI spaces with rational dilations*,

   - January 2007, Workshop on Harmonic and Geometric Analysis and Applications, Louisiana State University, Baton Rouge, Louisiana. (25 min.)
   - October 2006, Wavelet Seminar, Washington University, St. Louis, Missouri. (1 hour)

16. *The nonholonomy of the rolling sphere*, June 2006, REU Smorgasbord Seminar, Cornell University, Ithaca, New York. (1 hour)

15. *Projective multiresolution analysis for rational dilations*, May 2006, Analysis Seminar, University of Oregon, Eugene, Oregon. (1 hour)

14. *Orthogonal wavelet frames and vector-valued discrete wavelet transforms*, May 2006, Current Trends in Harmonic Analysis and Its Applications: Wavelets and Frames, University of Colorado at Boulder, Boulder, Colorado. (20 min.)

13. *Basic applications of wavelets*, March 2005, Wavelet Seminar, Washington University, St. Louis, Missouri. (1 hour)

12. *Shift-invariant frames and the frame potential*, June 2004, ShowMe Analysis Seminar 2004, University of Missouri-Columbia, Columbia, Missouri. (25 min.)

11. *Nonseparable bidimensional filter banks associated with oversampled wavelet transforms*, May 2004, Second International Conference on Computational Harmonic Analysis, Vanderbilt University, Nashville, Tennessee. (30 min.)

10. *Convolutional frames and the frame potential*, March 2004, Washington University and University of Zagreb Workshop on Wavelets, Washington University, Saint Louis, Missouri. (1 hour)

9. *Multiresolution operators in wavelet theory*, April 2003, Analysis Seminar, Georgia Institute of Technology, Atlanta, Georgia. (1 hour)

8. *Co-affine systems in $\mathbb{R}^d$*, March 2003, Spring Southeastern Sectional Meeting of the AMS, Special Session on Frames, Wavelets, and Tomography, Louisiana State University, Baton Rouge, Louisiana. (25 min.)

7. *Oversampling wavelet frames*, January 2003, Wavelets, Frames, and Operator Theory Workshop, University of Maryland at College Park, College Park, Maryland. (30 min.)

6. *Quasi-affine systems based on the à trous algorithm*, December 2001, 18th Auburn Mini-conference on Harmonic Analysis and Related Areas, Auburn University, Auburn, Alabama. (20 min.)

5. *Probability in dungeons and dragons*, November 2001, Math Circles Discussion, Washington University, Saint Louis, Missouri. (Math Circles involves interactive discussions in which middle-school students are exposed to interesting mathematical topics.)

4. *An introduction to wavelets*, November 2001, Math Club, McKendree College, Lebanon, Illinois. (1 hour)

3. *The hat problem*, October 2001, Math Club, Washington University, Saint Louis, Missouri. (1 hour)

2. *The use of a piezoelectric double amplifier active-skin in the control of panel radiation*, June 1997, Joint Meeting: 133rd Acoustical Society of America Meeting and NOISE-CON '97, Pennsylvania State University, State College, Pennsylvania, J. Acoust. Soc. Am., **101**(5), pp. 3108, May 1997. (15 min.)

1. *Control of structural radiation with an integrated, piezoelectric double amplifier skin*, April 1997, 1997 Office of Naval Research Transducer Materials and Transducers Workshop, Pennsylvania State University, State College, Pennsylvania. (15 min.)