Brooks K. Emerick | Curriculum Vitae

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Appointments

Kutztown University — **Kutztown, PA**
Associate Professor — *2022–Present*
Assistant Professor — *2017–2022*

Trinity College — **Hartford, CT**
Visiting Assistant Professor — *2014–17*

Education

University of Delaware — **Newark, DE**
Ph.D. in Applied Mathematics — *07/2014*
Advisors: Dr. Gilberto Schleiniger and Dr. Bruce Boman

Dissertation: *Modeling molecular and tissue dynamics in the human colonic crypt: An investigation into colon cancer development*
Advisors: Dr. Gilberto Schleiniger and Dr. Bruce Boman

University of Delaware
M.S. in Applied Mathematics — *05/2011*

Shippensburg University — **Shippensburg, PA**
B.S. in Applied Mathematics — *05/2009*

Publications

Peer-Reviewed Journal Articles

[1] Ko-Hsin Hsu and **Brooks Emerick**. "Police personnel allocation and homicide clearance." *to be submitted to Journal of Applied Social Science.* (submitted 6 December 2022).

[2] Abhyudai Singh and **Brooks Emerick**. "Coexistence conditions in generalized discrete-time models of insect population dynamics." *Ecological Modelling.* (10 October 2022), DOI: 10.1016/j.ecolmodel.2022.110148.

[3] Abhyudai Singh and **Brooks Emerick**. "Generalized stability conditions for host-parasitoid population dynamics: Implications for biological control." *Ecological Modelling.* (29 June 2021), DOI: 10.1016/j.ecolmodel.2021.109656.

[4] Myung Song, **Brooks Emerick**, Yun Lu, and Francis Vasko. "When to use integer programming software to solve large multi-demand multidimensional knapsack problems: A guide for operations research practitioners." *Engineering Optimization.* (25 June 2021), DOI: 10.1080/0305215X.2021.1933965.

[5] **Brooks Emerick**, Yun Lu, and Francis Vasko. "Using machine learning to predict the number of alternative solutions to a minimum cardinality set covering problem." *International Journal of Industrial Optimization.* (1 February 2021), 2(1), pp. 1–16. DOI: 10.12928/ijio.v2i1.2948.

[6] Tao Zhang, Koree Ahn, **Brooks Emerick**, Shirin R. Modarai, Lynn M. Opdenaker, Juan Palazzo, Gilberto Schleiniger, Jeremy Z. Fields, and Bruce M. Boman. "APC mutations in human colon lead to decreased neuroendocrine maturation of ALDH+ stem cells that alters GLP-2 and SST feedback signaling: Clue to a link between WNT and retinoic acid signalling in colon cancer development." *PLOS One.* (10 September 2020), 15(10), DOI: 10.1371/journal.pone.0239601.

[7] David A. Edwards, **Brooks Emerick**, Anna Georgieva Kondic, Kristian Kiradjiev, Christopher Raymond, and Maxim Zyskin. "Mathematical models for the effect of anti-vascular endothelial growth

factor on visual acuity." *Journal of Mathematical Biology.* (24 September 2020), pp. 1–32, DOI: 10.1007/s00285-020-01544-4.

[8] **Brooks Emerick**, Abhyudai Singh, and Safal Raut Chhetri. "Global redistribution and local migration in semi-discrete host-parasitoid population dynamic models." *Journal of Mathematical Biosciences.* (22 June 2020), 327, DOI: 10.1016/j.mbs.2020.108409.

[9] **Brooks Emerick**, Bruce M. Boman, and Gilberto Schleiniger. "Multi-scale modeling of APC and β-catenin regulation in the human colonic crypt." *Journal of Mathematical Biology.* (4 January 2018), 76(7), pp. 1797–1830, DOI: 10.1007/s00285-017-1204-8.

[10] **Brooks Emerick**, Bruce M. Boman, and Gilberto Schleiniger. "A kinetic model to study the regulation of β-catenin, APC, and Axin in the human colonic crypt." *Journal of Mathematical Biology.* (7 March 2017), 75, pp. 1171–1202, DOI: 10.1007/s00285-017-1112-y.

[11] Allison Tierney, Nhat Pham, Kunwei Yang, **Brooks Emerick**, and Michelle Kovarik. "Interspecies comparison of peptide substrate reporter metabolism using compartment based modeling." *Analytical and Bioanalytical Chemistry.* (29 November 2016), 409, pp. 1173–1183, DOI: 10.1007/s00216-016-0085-9.

[12] **Brooks Emerick** and Abhyudai Singh. "The effects of host-feeding on stability of discrete-time host-parasitoid population dynamic models." *Journal of Mathematical Biosciences.* (February 2016), 272, pp. 54–63, DOI:10.1016/j.mbs.2015.11.011.

[13] Ibrahim Diakite, David A. Edwards, **Brooks Emerick**, Mark Panaggio, Angela Peace, Christopher Raymond, and Matt Zumbrum. "Improving a fuel cell assembly process." *Mathematics-in-Industry Case Studies*, (February 2014), 6, pp. 22–47.

Book Chapters

[1] **Brooks Emerick**. "The mathematics of host-parasitoid population dynamics." In *Foundations of Undergraduate Research in Mathematics: Mathematics Research for the Beginning Student, Volume 2.* Springer International Publishing. (22 November 2022)

Conference/Workshop Proceedings

[1] **Brooks Emerick**, Myung Soon Song, Yun Lu, and Francis Vasko. "An application of machine learning tools to predict the number of solutions for a minimum cardinality set covering problem." *Proceedings of the International Conference on Optimization and Learning* (*OLA 2023*). (submitted 16 December 2022).

[2] Abhyudai Singh and **Brooks Emerick**. "Hybrid systems framework for modeling host-parasitoid population dynamics." *Proceedings of the 2020 59th IEEE Conference on Decision and Control.* (15 July 2020).

[3] Anna Kondic, David A. Edwards, **Brooks Emerick**, Kristian Kiradjiev, Christopher Raymond, L. Barnes, S. Hussung, D. Jonas, J. Slepoi, M. Moye, Maxim Zyskin, M. Sirlanci, and S. Dhar. "Parametric models for clinical measurements in ophthalmology." *Proceedings of the Thirty-Fifth Workshop on Mathematical Problems in Industry.* (June 2019).

[4] Matthew Doyle, Ferran Brosa Planella, Jen Bryson, **Brooks Emerick**, Daniel Fong, Casey Johnson, Ayse Kabatas, Greg Murphy, Tracy Stepien, and Isaac Tate. "Investigating Fontan failure using mathematical modeling." *Proceedings of the Thirty-Fourth Workshop on Mathematical Problems in Industry.* (June 2018).

[5] Bruce M. Boman, Thien-Nam Dinh, Keith Decker, **Brooks Emerick**, Christopher Raymond, and Gilberto Schleiniger. "Why do Fibonacci numbers appear in patterns of growth in nature? A model

for tissue renewal based on asymmetric cell division." *The Fibonacci Quarterly.* (December 2017), 55(5), pp. 30–41.

[6] Marco Montes de Oca, David A. Edwards, **Brooks Emerick**, Eli Goldwyn, Erik Palmer, M. Vazquez, M. Sirlanci, P. Narayanan, M. Chugunova, and I. de Teresa. "Hybrid programmatic TV markets." *Proceedings of the Thirty-Second Workshop on Mathematical Problems in Industry.* (June 2016).

[7] Emma Campbell, David A. Edwards, **Brooks Emerick**, D. Rumschitzki, Chris Breward, R. O. Moore, Christopher Raymond, and D. W. Schwendeman. "Desulfurization of natural gas for fuel cells." *Proceedings of the Thirty-First Workshop on Mathematical Problems in Industry.* (June 2015).

[8] R. Ramanan, Ibrahim Diakite, David A. Edwards, **Brooks Emerick**, Mark Panaggio, Angela Peace, Christopher Raymond, and Matt Zumbrum. "Fuel cell assembly process for high productivity." *Proceedings of the Twenty-Eighth Workshop on Mathematical Problems in Industry.* (June 2012).

[9] Zeal Jagannatha, Nicole Peterson, Sean Quigley, **Brooks Emerick**, Christopher Earl, and Sean McCulloch. "The shared shortest path problem in graphs." *Proceedings of 2011 MCURCSM*, (November 2011), Denison University.

Papers to be submitted

[1] **Brooks Emerick** and Abhuydai Singh. "Semi-discrete modeling of specialist and generalist parasitoids in host-parasitoid population dynamics." *to be submitted to Journal of Mathematical Biosciences.* (in process).

[2] **Brooks Emerick**, Xiangyi Tao, and Abhuydai Singh. "Semi-discrete modeling of hyperparasitoid populations in host-parasitoid population dynamics." *to be submitted to Journal of Mathematical Biosciences.* (in process).

Talks and Presentations

Conferences

Joint Mathematics Meeting, Seattle, WA *2022*
Invited [Virtual] Talk: "Ecological modeling of hyperparasitoids in host-parasitoid population dynamics."

The 7th International Conference on Machine Learning, Optimization, and Data Science, Grasmere, Lake District, England – UK *2021*
Contributed [Virtual] Talk: "Using machine learning to predict the number of alternative solutions to a minimum cardinality set covering problem."

Joint Mathematics Meeting, Denver, CO *2020*
Contributed Talk: "Infected-host-feeding in semi-discrete host-parasitoid population dynamics."

Joint Mathematics Meeting, Baltimore, MD *2019*
Contributed Talk: "Stabilizing effects of patch-use and migration in semi-discrete host-parasitoid models."

EPaDel Section of the MAA Regional Conference, Philadelphia, PA *2018*
Contributed Talk: "Semi-discrete modeling for host-parasitoid population dynamics."

Joint Mathematics Meeting, Atlanta, GA *2017*
Contributed Talk: "The effects of parasitoid migration on stability of discrete-time host-parasitoid population dynamic models."

Northeastern Section of the MAA Regional Meeting, Hartford, CT *2016*
Contributed Talk: "Semi-discrete modeling for host-parasitoid population dynamics."

Joint Mathematics Meeting, Seattle, WA *2016*
Contributed Talk: "The effects of host-feeding on stability of discrete-time host-parasitoid population dynamic models."

The Society for Mathematical Biology Annual Meeting and Conference, Tempe, AZ *2013*
Contributed Talk: "Modeling the Wnt pathway in the colonic crypt; from subcellular to cellular descriptions."

9th AIMS Conference on Dynamical Systems and Differential Equations, Orlando, FL *2012*
Poster: "A reaction diffusion model for cell populations in the human colonic crypt."

3rd SIAM/MAA Mid-Atlantic Regional Student Conference on Applied Mathematics, Shippensburg, PA *2011*
Contributed Talk: "A reaction diffusion model for cell populations in the human colonic crypt."

Celebration of Student Research Conference, Shippensburg University *2009*
Poster: "Simulating the Rubella virus using the classic SIR model."

Ohio Five Summer Science Research Symposium, Ohio Wesleyan University, Delaware, OH *2008*
Poster: "The shared shortest path problem in graphs."

EPaDel Section of the MAA Regional Conference, Gettysburg College, Gettysburg, PA *2008*
Talk: "Simulating the Rubella virus using the classic SIR model."

Annual Undergraduate Math Conference, Shippensburg University *2008*
Talk: "Exceptional units."

Seminars and Colloquia

Differential Equations Lecture Series, St. Mary's College of Maryland *2021*
Invited Talk: "Modeling the Wnt pathway in the human colonic crypt."

Mathematics Colloquium, Kutztown University *2018*
Invited Talk: "Exploring pattern formation and Turing instability in reaction-diffusion systems."

Mathematics Colloquium, Trinity College *2016*
Invited Talk: "Semi-discrete modeling for host-parasitoid population dynamics."

Mathematics Seminar, Shippensburg University *2013*
Invited Talk: "Modeling the Wnt pathway in the human colonic crypt; from subcellular to cellular descriptions."

Biology Seminar, Westminster College *2013*
Invited Talk: "Modeling the Wnt pathway in the human colonic crypt."

Stem Cell Research Seminar, University of Delaware *2011*
Talk: "Mathematically modeling the cell populations in the human colon."

Grants

"MAA Preparation for Industrial Careers in Mathematical Sciences (PIC Math) Program."
NSF Grant DMS-1722275 ($4000) *2021*

"Mathematical modeling and prediction of Inflow an Infiltration in Kutztown, PA's Sanitary Sewer System."
Kutztown University Bringing Experiences About Research in Summer (KU BEARS) Grant ($2000) *2021*

(Senior Personnel) "Emerging Mathematics and Computer Science (EMACS) Scholars Program"
NSF Grant through S-STEM Program ($999,758) *2020*

"Assessment of Implementing Application Projects for the Calculus Sequence", Kutztown University
Assessment Grant, Co-PI ($5000) *2020*

"An examination of Fontan circulation using differential equation models and numerical analysis."
KU BEARS Grant ($2000) *2020*

"Stability of quadratic response migration effects in host-parasitoid models."
KU BEARS Grant ($2000) *2018*

Teaching Experience

Kutztown University

Course Instructor *2017–Present*

- MAT 017 - Introduction to Mathematics (Spring 2021-23), [Online] (Summer 2018-19, 21-22)
- MAT 105 - College Algebra (Spring 2022), [Online] (Winter 2019-20; Summer 2021)
- MAT 106 - Trigonometry (Fall 2018-19, 21-22; Spring 2019) [Online] (Spring 2023)
- MAT 115 - Precalculus (Spring 2020; Winter I.I. 2021) [Online] (Winter 2022-23)
- MAT 140 - Applied Statistical Methods (Fall 2017-19; Spring 2018, 20)
- MAT 181 - Calculus I (Fall 2017-22; Spring 2018-23)
- MAT 182 - Calculus II (Spring 2018-20; Winter I.I. 2019; Fall 2020-21; Spring I.I. 2021)
- MAT 210 - Mathematical Computing and Typesetting (Spring 2022)
- MAT 270 - Biostatistics (Fall I.I. 2020)
- MAT 332 - Numerical Analysis (Spring I.I. 2021)
- MAT 340 - Differential Equations (Spring 2019; Summer I.I. 2021)
- MAT 347 - Introduction to Dynamical Systems (Spring I.I. 2023)
- MAT 361 - Operations Research I (Fall 2020-22)
- MAT 362 - Operations Research II (Spring 2021, 23)
- MAT 473 - Partial Differential Equations (Fall I.I. 2019-20, 22)

Trinity College

Course Instructor *2014–17*

- MATH 107 - Essential Statistics (Fall 2014)
- MATH 131 - Calculus I (Fall 2014-15)
- MATH 132 - Calculus II (Spring 2015)
- MATH 207 - Statistical Data Analysis (Spring 2015; Fall 2016)
- MATH 210 - Scientific Computing with MATLAB [Seminar] (Fall 2015)
- MATH 228 - Linear Algebra (Fall 2015; Spring 2016)
- MATH 231 - Calculus III (Fall 2016)
- MATH 234 - Differential Equations (Spring 2016-17)
- MATH 254 - Mathematical Modeling II (Spring 2017)
- MATH 305 - Probability (Fall 2015)

University of Delaware

Course Instructor *2010–13, 17*

- MATH 117 - Precalculus for Scientists and Engineers (Summer 2010-12)
- MATH 201 - Statistics for Business and Economics (Summer 2017)
- MATH 221 - Business Calculus (Winter 2010)
- MATH 241 - Analytic Geometry and Calculus A (Winter 2011)
- MATH 242 - Analytic Geometry and Calculus B, with Maple lab (Winter 2012-13)

Teaching Assistant *2009–13*

- MATH 221 - Business Calculus (Fall 2009)
- MATH 241 - Analytic Geometry and Calculus A (Fall 2011-12)
- MATH 243 - Analytic Geometry and Calculus C (Spring 2012)
- BISC 316 - Experimental Physiology (Fall 2010; Spring 2011)

Graduate Review of Important Problems for Success, (GRIPS) *2011–12*

- MATLAB (Summer 2011)
- Multivariable Calculus (Summer 2012-13)

Shippensburg University

Supplemental Instructor *2008–09*

- MATH 050 - Developmental Mathematics (Fall 2008; Spring 2009)

Undergraduate Research Directed

Kutztown University

KU BEARS REU

Paul Barton *2021*
"Mathematical modeling and prediction of Inflow and Infiltration in Kutztown, PA's Sanitary Sewer System."

Vanessa Maybruck *2020*
"An examination of Fontan circulation using differential equation models and numerical analysis."

Safal Raut Chhetri *2018*
"Stability of quadratic response migration effects in host-parasitoid models." (results published)

Honors Capstone Project

Vanessa Maybruck *2019-20*
"Mathematical modeling of pressure regimes in Fontan blood flow circulations."

Moravian College

CEM REU

Xiangyi Tao, Grace Berger, Donavio Leeks, and Xinyi Fan *2020*
"Investigating the effects of hyperparasitism in synchronous and asynchronous host-parasitoid models."

Trinity College

Summer Research Program

Norah Do *2016*
"Coexistence with variability of risk in host-parasitoid models."

Nhat Pham *2016*
"Modeling the degradation of the VI-B peptide in human cell cultures." (results published)

Eduardo Murillo *2016*
"Stability of no-return migration in host-parasitoid models."

Jeremy Dam *2015*
"Infected host-feeding and migration in host-parasitoid models."

Courses, Seminars, and Workshops

Mathematical Problems in Industry (MPI), Attendee *2012, 2015–16, 2018–19, 2021*

- "Differential privacy in travel data," advised by Jeff Dumont (Resource Systems Group)
- "Mathematical modeling of macular degeneration of the eye," advised by Anna Georgieva Kondic (Certara)
- "Mathematical modeling of Fontan heart failure," advised by Matthew Doyle (Toronto General Hospital)
- "Desulfurization of natural gas for fuel cells," advised by Emma Campbell (Bloom Energy)
- "Hybrid programmatic television markets," advised by Marco Montes de Oca (Clypd)
- "Fuel cell assembly process flow for high productivity," advised by Ram Ramanan (Bloom Energy)

Graduate Student Mathematical Modeling Camp (GSMMC), Mentor *2021*
"Ecological modeling of host-parasitoid population dynamics."

Center for the Enhancement of Teaching (CET), Attendee *2020*
"Creating Engaging Content for Asynchronous and Flipped Learning Classrooms"

Teaching Online Certification Course (TOCC), Attendee *2018*
Five-week, instructor-led online course.

George Mason Modeling Days (GMMD), Attendee *2014*
"Dynamic Modeling of Animal and Human Growth," advised by Carson Chow (NIH)

STEM Active Learning Workshop, Attendee *2011*
"Process oriented guided inquiry and problem based learning," presented by The POGIL Project.

UD Annual Teaching Assistant Conference, TA Fellow *2011*

Professional Affiliations

Consortium for Mathematics and its Applications (COMAP) 2019–Present

Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations (SIMIODE) 2017–Present

Mathematical Association of America (MAA) 2014–Present

Society for Mathematical Biology (SMB) 2012–Present

Society of Industrial and Applied Mathematics (SIAM) 2008–Present

Service

Professional Service

PASSHE STEM Student Research Conference 2019, 2021

- Co-organizer, Judge, 2021
- Judge, 2019

COMAP Mathematical Contest in Modeling (MCM), Judge 2019–Present

Undergraduate Research Poster Presentations at JMM, Judge 2020

Saturday Morning Math Circle, Mentor 2013

University Service

KU Organ Donors, Ultimate Frisbee Club, Primary Advisor 2021–Present

Academic Technology Committee, Member 2021–Present

Kleffel Award Committee, Member 2021–Present

College of Liberal Arts and Sciences Assessment Committee , Member 2021–Present

Honorary Degree Committee , Recording Secretary 2020–Present

APSCUF Representative Council, Member 2019–Present

Professional Development Committee , Member 2019–Present

Liberal Arts and Sciences Technology Committee 2018–Present

- Recording Secretary, 2021 – Present
- Member, 2018 – Present

Departmental Service

General Education Committee, Chair 2018–Present

Program Review Committee 2018–Present

- Chair, 2021 – Present
- Member, 2018 – Present

Calculus Committee, Member 2018–Present

Program Assessment Committee, Member 2018–Present

Student Affairs Committee, Member 2018–Present

Recruitment Committee, Member 2019–Present

KU Math Club 2018–Present

- Advisor, 2020 – Present
- Co-Advisor, 2018 – 2020

KU Statistics and Actuarial Science Club, Co-Advisor 2017–19

SIMIODE Student Competition Using Differential Equation Modeling, Coach and Organizer 2017

UD Hallenbeck Graduate Student Seminar, Coordinator *2012–13*

UD SIAM Student Chapter, President *2010–11*

Honors and Awards

Kutztown University

Nomination for the John P. Schellenberg Award for Excellence in Teaching and Learning *2020, 2021*

Appointment to Graduate Faculty status *2019*

University of Delaware

University Dissertation Fellowship *2013*

Excellence in Teaching Award Nominee *2012*

Winter Research Review Travel Award *2012*

Baxter-Sloyer Graduate Teaching Award *2011*

UNIDEL Research Fellowship *2010*

SIAM Outstanding Efforts and Accomplishments Award *2011*

Shippensburg University

Michael D. Seyfried Memorial Mathematics Scholarship Reward *2009*

Senior Award for Applied Mathematics and Statistics *2009*

Student Research Achievement Award *2009*

Dean's List, all semesters *2005–09*