

RABIE RAMADAN

1010 Arch St, Unit 210, Philadelphia, PA 19107

rabie.ramadan@temple.edu ◊ (215) 824-5071 ◊ www.rabieramadan.com

EDUCATION

Temple University, Philadelphia, PA, USA *August 2014 – May 2020*

PhD in Mathematics (Thesis in Applied Math)

Thesis Title: Non-equilibrium Dynamics of Second Order Traffic Models

American University of Beirut, Beirut, Lebanon *August 2009 – May 2014*

Bachelor of Engineering, Civil and Environmental Engineering (with distinction)

Bachelor of Science, Applied Mathematics (with high distinction)

Concentration in Transportation Engineering

Minor in Operations Research

RELEVANT EXPERIENCE

Temple University, Research Assistant Professor, Philadelphia, PA, USA *June 2020 – present*

- Collaborate with researchers from seven academic institutions and industry partners on the CIRCLES project
- Take a leadership role in the development and calibration of energy and microscopic traffic flow models
- Regularly present my teams findings to the other campuses and institutions
- A core participant of the 2020 IPAM long program: “Mathematical Challenges for Autonomous Vehicles”
- Mentor an undergraduate student from the Electrical Engineering department on her undergraduate research
- Teach undergraduate mathematics courses at the College of Science and Technology
- This appointment partially funded by the DOE grant DE-EE000887 (EERE, VTO), [multi-institutional grant]

MIT, Visiting Researcher, Boston, MA, USA *May – June 2019*

- Derived a reduced linear model for weak solutions of second order non-linear traffic models
- Used numerical methods to implement the derived model in MATLAB
- Presented project results at a numerical analysis conference
- Acquired experience in working on fast-paced projects with an expert in the field

Temple University, Instructor Philadelphia, PA, USA *August 2015 – December 2019*

- Taught Calculus II, Calculus I and Pre-Calculus, and assisted in teaching advanced math classes
- Mentored first-year graduate students and helped them prepare for the Complex Analysis qualifying exam
- Communicated complex ideas and worked effectively with students from a variety of backgrounds
- Developed management, leadership and engagement skills for groups of 3–125 students

University of Texas, Research Assistant Austin, TX, USA *June – August 2013*

- Used a digital image correlation system, scripted in MATLAB, to monitor surface strains on steel bars
- Participated in constructing reinforced concrete columns and conducting seismic performance tests
- Learned to thrive in a collaborative, exceptionally organized and tightly scheduled laboratory

PUBLICATIONS

G. Gunter, S. Shanto, R. Ramadan, B. Seibold, D. Work, **Challenges of microsimulation calibration with traffic waves using aggregate measurements**, *submitted to Transportation Research Board.* *August 2020*

E. Butler, A. Chen, R. Ramadan, K. Ruparel, T. Moore, F. Zhang, H. Shou, R. Gur, T. Nichols, R. Shinohara, **Statistical pitfalls in brain age analyses**, *revising submission (NeuroImage).* *June 2020*

R. Ramadan, B. Seibold, R. Rosales, **Structural properties of the stability of Jamitons**, *accepted to ICIAM2019 SEMA SIMAI Springer Series.* *November 2019*

TALKS AND PRESENTATIONS

Structural Properties of the Stability of Jamitons

presented at the seminar of the IPAM long program: Mathematical Challenges for AVs (Virtual) December 2020

Non-equilibrium Dynamics of Second Order Traffic Models

presented at the Applied Math seminar (Temple University) February 2020

A Computational Study on the Stability of Jamitons

presented at the Mid-Atlantic Numerical Analysis Day (Temple University) November 2019

Traffic Flow Control and Fuel Consumption Reduction via Moving Bottlenecks

presented at IPAM Traffic Flow Management Reunion Conference II (UCLA) June 2018

POSTERS PRESENTED

Non-equilibrium Dynamics of Second Order Macroscopic Traffic Models

presented at the IPAM long program: Mathematical Challenges for AVs December 2020

Fitting and Averaging 2nd Order Macroscopic Models with Traffic Instabilities

presented at the IPAM Workshop on Autonomous Vehicles (UCLA) February 2019

Traffic Flow Control and Fuel Consumption Reduction via Moving Bottlenecks

presented at SIAM Conference on Nonlinear Waves and Coherent Structures August 2016

CURRENT RESEARCH

Topic 1: Non-equilibrium Dynamics of Second Order Macroscopic Traffic Models

Collaborators: Prof. Benjamin Seibold (Temple University) and Prof. Rodolfo Ruben Rosales (MIT)

I develop, analyze, and quantify the inhomogeneous Aw-Rascle-Zhang (ARZ) traffic model, which possesses instabilities and traveling waves solutions (Jamitons). Those non-equilibrium phenomena are important components of vehicular traffic flow; however, models currently used in practice are limited to first-order models that describe an averaged equilibrium flow profile only. Besides the mathematical analysis into the dynamic stability of Jamitons, I work on quantifying the accuracy of the ARZ model, providing procedures to calibrate it with real data, and devising effective and robust numerical cell-transmission models to facilitate the usability of this model in engineering practice. In addition, I explore possible averaged models that capture the cumulative effects of the ARZ model, but maintains a simpler structure that is easier to solve both analytically and numerically.

Topic 2: Traffic Flow Smoothing via Artificial Intelligence (AI) and connected autonomous vehicles (CAVs)

Collaborators: I am member of the CIRCLES research team, consisting of 40+ researchers from seven academic institutions and industry partners.

The CIRCLES project aims to demonstrate the concept of transfer learning, i.e. transfer a policy learned in a simulation to a field demonstration using connected and autonomous vehicles (CAVs) in live traffic. The project would also provide the opportunity for engagement with major automotive partners and federal agencies (e.g., DOE, DOT), the latter of which would help advance future legislation. To that end, the team will:

- Discover new techniques in multi-agent deep reinforcement learning
- Build sensing infrastructure and technology to collect data and measure impacts
- Develop, calibrate, and validate traffic flow and vehicular energy models
- Develop control algorithms to transfer learned policies to CAVs

I take a leadership role in the development and calibration of vehicle based energy models as well as microscopic traffic flow models that exhibit unstable behaviour manifesting as traffic waves.

SKILLS

Languages English, Arabic
Technical Statistics, Machine learning, Data analytics & visualization, Mathematical modeling, Control theory
Software MATLAB, R, Python, L^AT_EX, VBA, HTML/CSS, JavaScript, Microsoft Office

MODELING PROJECTS

Line-following Car Robot & Self-Balancing Pendulum, *Control Theory* September – December 2018

- Designed PID controllers, implemented them in Python and deployed them to a LEGO EV3 set

Amber Grain Bakery Sourdough Modeling Project, *Mathematical Modeling* January – May 2018

- Conducted experiments and developed predictive models for the time a starter needs to be ready for baking

FIAT Steel Bridge Assessment, *Civil Engineering Final Year Project* September 2013 – May 2014

- Performed a transportation, structural & economic analysis of the FIAT steel bridge, located in Beirut.

AWARDS, FUNDING AND FELLOWSHIPS

Doctoral Dissertation Completion Grant January 2020

CST Outstanding Teaching Assistant Award December 2019

Temple University Presidential Fellowship August 2014

American University of Beirut Full Scholarship August 2009

EXTRACURRICULAR ACTIVITIES

Philadelphia Futures, Tutor, *Philadelphia, PA, USA* September 2017 – May 2018

- Volunteered to tutor low-income high school students struggling with algebra and calculus

Train/Train Lebanon NGO, Volunteer, *Beirut, Lebanon* Summer 2012

- Participated in organizing a workshop about the feasibility of reviving the old train in Lebanon
- Gained experience planning large-scale events for academics and local politicians