



Dr. Isam Al-Darabsah

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Research Interests

Mathematical Biology: My research lies in building mathematical models and analyzing their nonlinear dynamics and bifurcations. I focus on ordinary and delay differential equations and their applications in immunology, epidemiology, ecology, and neural networks. Besides the theoretical analysis, I apply numerical methods and simulations to study more aspects of the models' properties and implement model calibration.

My research interests are in mathematical biology and nonlinear dynamics. I am particularly interested in ordinary and delay differential equations and their applications in immunology, epidemiology, ecology, and neural networks.

Other Interests: Connected autonomous vehicles networks and traffic flow.

Education

Ph.D. in Mathematics 9/2014 – 8/2018
 Memorial University of Newfoundland St. John's, NL, Canada

Dissertation title: Time Delayed Models in Population Biology and Epidemiology [\[Link\]](#)

Concentration: delay differential equations, mathematical modeling, and applied dynamical systems

- Pass with distinction
- Fellow of the School of Graduate Studies

M.Sc. in Mathematics 9/2012 – 8/2014
 Memorial University of Newfoundland St. John's, NL, Canada

Thesis title: Dynamics on a General Stage Structured n Food Chains [\[Link\]](#)

Concentration: delay differential equations, mathematical modeling, and applied dynamical systems

M.Sc. in Mathematics 8/2006 – 8/2009
 Yarmouk University Irbid, Jordan

Thesis title: Integral Equations with Delay Arguments [\[Link\]](#)

Concentration: numerical analysis, integral equations, and Integro-differential equations

B.Sc. in Mathematics 8/2002 – 6/2006
 Yarmouk University Irbid, Jordan

- Graduated third of class out of 85 students (3/85)
- Dean's list of excellence for outstanding academic records
- Ranked first in the Mathematics Achievement Exam in Jordan (1/451)

Work Experience

• Assistant Professor 2/2023 – present
 Department of Mathematics and Statistics, Jordan University of Science and Technology Irbid, Jordan

• Research Associate 11/2022 – 12/2022
 Department of Applied Mathematics, University of Waterloo Waterloo, ON, Canada

- PIMS (Pacific Institute for the Mathematical Sciences) Postdoctoral Fellow 9/2020 – 8/2022
 Department of Mathematics, University of Manitoba Winnipeg, MB, Canada
 – Research: In-host modeling and Notch signaling pathway
- Postdoctoral Fellow 9/2018 – 8/2020
 Department of Applied Mathematics, University of Waterloo Waterloo, ON, Canada
 – Research: Bifurcations in neural models with time delay
- Teaching Assistant 9/2012 – 8/2018
 Department of Mathematics and Statistics, Memorial University of Newfoundland St. John's, NL, Canada
- Full-Time Lecturer 8/2010 – 8/2012
 Department of Mathematics, Yarmouk University Irbid, Jordan
- Part-Time Instructor Summer 2010
 Department of Mathematics, Yarmouk University Irbid, Jordan
 Department of Mathematics and Statistics, Jordan University of Science and Technology Irbid, Jordan

Publications

The * indicates graduate student.

Journal Articles

- J1. **I. Al-Darabsah**, K.-L. Liao, and S. Portet, *A simple in-Host Model for COVID-19 with Treatments: Model Prediction and Calibration*, *J. Mathematical Biology* 86 (20) (2023): 343-376.
 DOI: [10.1007/s00285-022-01849-6](https://doi.org/10.1007/s00285-022-01849-6).
- J2. T-Y. Wu, S. Krishnamoorthi, K. Boonyaves, **I. Al-Darabsah**, R. Leong, A. M. Jones, K. Ishizaki, K.-L. Liao and D. Urano, *G protein controls stress readiness by modulating transcriptional and metabolic homeostasis in Arabidopsis thaliana and Marchantia polymorpha*, accepted in *Molecular Plant*, October 2022.
- J3. **I. Al-Darabsah**, L. Chen, W. Nicola and S.A. Campbell, *The impact of small time delays on the onset of oscillations and synchrony in brain networks*, *Frontiers in Systems Neuroscience* 15 (2021).
 DOI: [10.3389/fnsys.2021.688517](https://doi.org/10.3389/fnsys.2021.688517).
- J4. **I. Al-Darabsah** and S.A. Campbell, *M-current induced Bogdanov-Takens bifurcation and switching of neuron excitability class*, *J. Mathematical Neuroscience* 11 (2021).
 DOI: [10.1186/s13408-021-00103-5](https://doi.org/10.1186/s13408-021-00103-5).
- J5. **I. Al-Darabsah**, *A time-delayed SVEIR model for imperfect vaccine with a generalized nonmonotone incidence and application to measles*, *Applied Mathematical Modelling* 91 (2021): 74-92.
 DOI: [10.1016/j.apm.2020.08.084](https://doi.org/10.1016/j.apm.2020.08.084).
- J6. **I. Al-Darabsah**, *Threshold dynamics of a time-delayed epidemic model for continuous imperfect-vaccine with a generalized nonmonotone incidence rate*, *Nonlinear Dynamics* 101 (2020): 1281-1300.
 DOI: [10.1007/s11071-020-05825-x](https://doi.org/10.1007/s11071-020-05825-x).
- J7. **I. Al-Darabsah** and S.A. Campbell, *A phase model with large time delayed coupling*, *Physica D: Nonlinear Phenomena* 411 (2020): 132559.
 DOI: [10.1016/j.physd.2020.132559](https://doi.org/10.1016/j.physd.2020.132559).
- J8. **I. Al-Darabsah** and Y. Yuan, *Dynamic analysis of a biocontrol of sea lice by age-structured model*, *Nonlinear Dynamics* 97 (2019): 1649–1666.
 DOI: [10.1007/s11071-019-05088-1](https://doi.org/10.1007/s11071-019-05088-1).

- J9. Y. Tian, **I. Al-Darabsah** and Y. Yuan, *Global dynamics in sea lice model with stage structure*, *Nonlinear Analysis: Real World Applications* 44 (2018): 283–304.
DOI: [10.1016/j.nonrwa.2018.05.007](https://doi.org/10.1016/j.nonrwa.2018.05.007).
- J10. **I. Al-Darabsah** and Y. Yuan, *A stage-structured model for fish stock with harvesting*, *SIAM J. on Applied Mathematics* 78 (2018): 145-170.
DOI: [10.1137/16M1097092](https://doi.org/10.1137/16M1097092)
- J11. M. Janaideh, M. Rakotondrabe, **I. Al-Darabsah** and O. Aljanaideh, *Internal model-based feedback control design for inversion-free feedforward rate-dependent hysteresis compensation of piezoelectric cantilever actuator*, *Control Engineering Practice* 72 (2018): 29-41.
DOI: [10.1016/j.conengprac.2017.11.001](https://doi.org/10.1016/j.conengprac.2017.11.001).
- J12. **I. Al-Darabsah** and Y. Yuan, *A periodic disease transmission model with asymptomatic carriage and latency periods*, *J. Mathematical Biology* 77 (2018): 343-376.
DOI: [10.1007/s00285-017-1199-1](https://doi.org/10.1007/s00285-017-1199-1).
- J13. **I. Al-Darabsah** and Y. Yuan, *A time-delayed epidemic model for Ebola disease transmission*, *Applied Mathematics and Computation* 290 (2016): 307-325.
DOI: [10.1016/j.amc.2016.05.043](https://doi.org/10.1016/j.amc.2016.05.043).
- J14. **I. Al-Darabsah**, X. Tang and Y. Yuan, *A prey-predator model with n patches, migrations and delays*, *Discrete & Continuous Dynamical Systems - B* 21 (2016): 737-761.
DOI: [10.3934/dcdsb.2016.21.737](https://doi.org/10.3934/dcdsb.2016.21.737).
- J15. K. Qazaqzeh, **I. Al-Darabsah** and A. Quraan, *The signature of rational links*, *New York J. Mathematics* 20 (2014): 183-194.
- Conference Proceedings**
- C1. **I. Al-Darabsah**, K.-F. Hsueh*, M. Al Janaideh, S.A. Campbell and D. Kundur, *Vulnerability of connected autonomous vehicles networks to periodic time-varying communication delays of certain frequency*, *International Conference on Intelligent Robots and Systems 2021 (IROS 2021)*, Prague, Czech Republic, September 2021.
DOI: [10.1109/IROS51168.2021.9636739](https://doi.org/10.1109/IROS51168.2021.9636739).
- C2. **I. Al-Darabsah**, M. Al Janaideh and S.A. Campbell, *Stability of connected autonomous vehicle networks with commensurate time delays*, *American Control Conference 2021 (ACC 2021)*, Orleans, Louisiana, USA, May 2021.
DOI: [10.23919/ACC50511.2021.9482938](https://doi.org/10.23919/ACC50511.2021.9482938).
- C3. **I. Al-Darabsah**, M. Al Janaideh and S.A. Campbell, *The effect of input signals time-delay on stabilizing traffic with autonomous vehicles*, *2021 IEEE International Conference on Robotics and Automation (ICRA)*, Xi'an, China, May 2021.
DOI: [10.1109/ICRA48506.2021.9561464](https://doi.org/10.1109/ICRA48506.2021.9561464).
- C4. O. Aljanaideh, M. Rakotondrabe, **I. Al-Darabsah**, M. Janaideh and K. Aljanaideh, *A model-based feedforward hysteresis compensator for micropositioning control*, *American Control Conference 2017 (ACC 2017)*, pp. 3506-3511, Seattle WA USA, May 2017.
DOI: [10.23919/ACC.2017.7963489](https://doi.org/10.23919/ACC.2017.7963489).
- C5. **I. Al-Darabsah** and Y. Yuan, *Dynamics of a general stage structured n parallel food chains*, *International Symposium on Mathematical and Computational Biology*, World Scientific, 2014, pp. 63-84, Toronto, Ontario, Canada, November 2013.
DOI: [10.1142/9789814602228_0004](https://doi.org/10.1142/9789814602228_0004).

Professional Activities

- Co-organizer of "Dynamical System and Applications" session, the 2022 CMS Summer Meeting, St. John's, Newfoundland and Labrador, Canada, June 3-6, 2022. [\[Link\]](#)
- ~~Session Chair, CP9: Neuroscience II Session, the SIAM Conference on the Life Sciences (LS20), California, U.S., June 10, 2020. (Conference cancelled due to COVID-19)~~
- Workshop Organizer, "Fields-CQAM Student Workshop on Dynamical Systems and Related Fields". October 2019. University of Waterloo, Ontario, Canada. [\[Link\]](#)

Awards and Scholarships

- Fellow of the School of Graduate Studies, Memorial University of Newfoundland, 2018. This title is awarded in recognition of outstanding academic achievement throughout the Ph.D. program.
- Pass with Distinction merit of the Ph.D. Dissertation defense, Memorial University of Newfoundland, 2018.
- The Memorial University of Newfoundland travels grant to attend the 2015 Canadian Mathematical Society Summer Meeting, Charlottetown, Prince Edward Island, Canada (1800 CAD).
- The Memorial University of Newfoundland travels grant to attend the BIOMAT 2013 conference, Toronto, Ontario, Canada (1800 CAD).
- A scholarship covering my M.Sc. and Ph.D. studies in Mathematics at the Memorial University of Newfoundland covers the tuition fees and living expenses, 2012-2018.
- Ranked first in the Mathematics Achievement Exam in Jordan, 2006, among 451 students (1/ 451), which is a general exam for all mathematics graduates in Jordan.
- Ranked third in the class out of 85 students (3/85) of my B.Sc. degree, Mathematics, class 2006, Yarmouk University, Irbid, Jordan.
- Dean's list of excellence for Outstanding Academic Records, Yarmouk University, Irbid, Jordan (2002-2006).

Presentations in Conferences and Seminars

- Time-Delayed Models in Population Biology and Epidemiology. Applied & computational math seminar, Department of Mathematics, University of Manitoba, Winnipeg, MB, Canada, November 3, 2020.
- ~~Bogdanov-Takens Bifurcation in a General Conductance-Based Neuron Model with the M-Current and Switching of Neuron Excitability Class. SIAM Conference on the Life Sciences (LS20), California, U.S., June 8-11, 2020. (Conference cancelled due to COVID-19)~~
- ~~Invited to give a talk in "Recent advances in theory and applications of functional differential equations" session at the CMS Canadian Mathematical Society 75th Anniversary Summer Meeting, Ottawa, Canada, June 5-8, 2020. (Conference cancelled due to COVID-19)~~
- Phase Models with Large Time Delayed Coupling. The International Conference on Applied Mathematics, Modeling and Computational Science (AMMCS), Wilfrid Laurier University, Waterloo, Ontario, Canada, August 18-23, 2019.
- A Prey-Predator Model with n Patches, Migrations and Delays. The 2015 Canadian Mathematical Society Summer Meeting, Charlottetown, Prince Edward Island, Canada, June 5-8, 2015.

- Dynamics of a General Stage Structured n Parallel Food Chains. The BIOMAT 2013 conference, the Fields Institute for Research in Mathematical Sciences, Toronto, Ontario, Canada, 04-08 November 2013.
- Applied Dynamical Systems Seminar, Department of Mathematics and Statistics, Memorial University of Newfoundland, St. John's, NL, Canada, 2013-2017.

Workshops and Summer Schools

- Fields-CQAM Student Workshop on Dynamical Systems and Related Fields, Department of Applied mathematics, University of Waterloo, Waterloo, Ontario, Canada, October 15, 2019.
- IRC Distinguished Lecture Series, Numerical Stability Analysis for Delay Differential and Renewal Equations, Laboratory for Industrial and Applied Mathematics, York University, Toronto, Ontario, Canada, August 27-29, 2018.
- The 2013 AARMS Summer School, Theme: Dynamical Systems and Mathematical Biology, July 15 - August 9, 2013, Memorial University of Newfoundland. Courses: Stochastic Modeling with Applications in Biology with Professors Linda Allen and Edward Allen, Texas Tech University, USA; and Mathematical Modeling in Developmental Biology and Medicine with Professor Philip Maini, University of Oxford, UK.
- The 2013 AARMS Workshop in Mathematical Biology, Memorial University of Newfoundland, St. John's, Canada, July 27-29, 2013.

Academic Service

Reviewer for journals:

- Communications in Nonlinear Science and Numerical Simulation
- Applied Mathematical Modelling
- Nonlinear Dynamics
- European Journal of Control
- Mathematical Reviews (MathSciNet), American Mathematical Society
- BMC Medicine
- Scientific Reports

Reviewer for conference proceeding:

- American Control Conference, Conference on Decision and Control, IEEE International Conference on Robotics and Automation, and International Conference on Intelligent Robots and Systems

Professional Development

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| • Teaching Skills Enhancement Program (Graduate Student Cohort)
Memorial University of Newfoundland | 2016 – 2017
St. John's, NL, Canada |
| • Graduate Program in Mathematics and Statistics Teaching
Memorial University of Newfoundland | 2016 – 2017
St. John's, NL, Canada |