

Kevin E.M. Church

NSERC POSTDOCTORAL FELLOW, MCGILL UNIVERSITY

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Education

University of Waterloo

Waterloo, Canada

PH.D APPLIED MATHEMATICS

September 2015 – July 2019

- Supervisors: Dr. Xinzhi Liu and Dr. Jun Liu
- Thesis title: *Invariant manifold theory for impulsive functional differential equations with applications*
- Completed *Fundamentals of University Teaching Program* through *Center for Teaching Excellence*

University of Ottawa

Ottawa, Canada

M.SC MATHEMATICS

September 2012 – November 2014

- Supervisor: Dr. Robert J. Smith? (the question mark is part of his name)
- Thesis title: *Applications of impulsive differential equations to the control of malaria outbreaks and...*

University of Ottawa

Ottawa, Canada

B.SC, HONOURS, MAJOR IN MATHEMATICS, MINOR IN LIFE SCIENCES

September 2008 – June 2012

- Undergraduate research project supervised by Dr. Robert J. Smith?

Employment

McGill University

Montreal, Quebec, Canada

NSERC POSTDOCTORAL FELLOW

September 2019 – Present

McGill University

Montreal, Quebec, Canada

LECTURER

September 2019 – Present

- Math 262 (Intermediate Calculus) : September 2020 – Present
- Math 263 (Ordinary Differential Equations for Engineers) : September 2019 – December 2019

University of Waterloo

Waterloo, Ontario, Canada

LECTURER, TEACHING ASSISTANT AND SUBSTITUTE LECTURER

September 2015 – July 2019

- Lecturer for MATH 127 (Calculus I for the Sciences) : Fall 2017 term
- Teaching Assistant: Various terms since September 2015
- Substitute lecturer (one week) for AMATH 451 (Introduction to Dynamical Systems).

University of Ottawa

Ottawa, Ontario, Canada

TEACHING ASSISTANT, TUTOR AND SUBSTITUTE LECTURER

September 2012 – April 2015

- Teaching Assistant: Various terms from September 2012 – December 2014
- Math Help Center: September 2014 – April 2015
 - Tutored students in first-year mathematics courses in a bilingual (English, French) environment.
- Substitute lecturer (two weeks) for MAT 5131 Ordinary Differential Equations (graduate level), MAT 2324 Ordinary Differential Equations (undergraduate level) and MAT 1332 Calculus II for the Life Sciences.

Honours, grants & fellowships

- 2020 **Applied Mathematics Doctoral Award**, University of Waterloo
- 2019 **NSERC Postdoctoral Fellowship**, Natural Sciences and Engineering Research Council of Canada *Two-year fellowship*
- 2019 **Joseph Wai-Hung Liu Graduate Scholarship**, University of Waterloo
- 2019 **Travel Grant**, Waterloo Institute for Complexity & Innovation
- 2018 **Graduate Fellowship**, Waterloo Institute for Complexity & Innovation
- 2018 **Finalist, Three Minute Thesis Competition**, University of Waterloo
- 2018 **Winner, Three Minute Thesis Competition – Mathematics Faculty Heat**, University of Waterloo

2017	Alexander Graham Bell Canada Graduate Scholarship , Natural Sciences and Engineering Research Council of Canada	<i>Held 2017 – 2019</i>
2015	President’s Graduate Scholarship , University of Waterloo	<i>Held 2015 – 2019</i>
2015	Ontario Graduate Scholarship , Government of Ontario	<i>Held 2015 – 2016</i>
2016	Best Student Paper Prize: Mathematics and Statistics , University of Ottawa	
2014	Honorable Mention, Excellence Award for Teaching Assistants , University of Ottawa	
2012	Admission Scholarship , University of Ottawa	<i>Held 2012-2014</i>
2011	Dean’s Honour List , University of Ottawa	

Works submitted or under review

On the Cauchy problem for impulsive differential equations with state-dependent delay

K.E.M. Church

UNDER REVIEW

Submitted October 2020

Rigorous continuation of periodic solutions for impulsive delay differential equations

K.E.M. Church and G.W. Duchesne

UNDER REVIEW

Submitted October 2020

Analysis of pandemic closing-reopening cycles using rigorous homotopy continuation

K.E.M. Church

UNDER REVIEW

Submitted September 2020

Computer-assisted methods for periodic orbits in vibrating gravitational billiards

K.E.M. Church and C. Fortin

UNDER REVIEW

Submitted September 2020

Invariant manifold-guided impulsive stabilization of delay equations

K.E.M. Church and X. Liu

CONDITIONALLY ACCEPTED, IEEE TRANSACTIONS ON AUTOMATIC CONTROL

Submitted December 2019

Publications in refereed journals

Eigenvalues and delay differential equations: periodic coefficients, impulses and rigorous numerics

K.E.M. Church

JOURNAL OF DYNAMICS AND DIFFERENTIAL EQUATIONS

In press

Cost-effective robust stabilization and bifurcation suppression

K.E.M. Church and X. Liu

SIAM JOURNAL ON CONTROL AND OPTIMIZATION, 57 (3), 2240–2268

June 2019

Computation of centre manifolds and some codimension-one bifurcations for impulsive delay differential equations

K.E.M. Church and X. Liu

JOURNAL OF DIFFERENTIAL EQUATIONS, 267 (6), 3852–3921

December 2019

Analysis of a SIR model with pulse vaccination and temporary immunity: stability, bifurcation and a cylindrical attractor

K.E.M. Church and X. Liu

NONLINEAR ANALYSIS: REAL WORLD APPLICATIONS, 50, 240–266

September 2019

Smooth centre manifolds for impulsive delay differential equations

K.E.M. Church and X. Liu

JOURNAL OF DIFFERENTIAL EQUATIONS, 265 (4), 1696–1759

August 2018

Continuous approximation of linear impulsive systems and a new form of robust stability

JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS, 457 (1), 616–644

K.E.M. Church and R.J. Smith?

January 2018

Bifurcation analysis and application for impulsive systems with delayed impulses

INTERNATIONAL JOURNAL OF BIFURCATION AND CHAOS, 27 (12), 1750186

K.E.M. Church and X. Liu

December 2017

Bifurcation of bounded solutions of impulsive differential equations

INTERNATIONAL JOURNAL OF BIFURCATION AND CHAOS, 26 (14), 1650242

K.E.M. Church and X. Liu

December 2016

Comparing malaria surveillance with periodic spraying in the presence of insecticide-resistant mosquitoes: Should we spray regularly or based on human infections?

MATHEMATICAL BIOSCIENCES, 276, 145–163

K.E.M. Church and R.J. Smith?

June 2016

Existence and uniqueness of solutions of general impulsive extension equations with specification to linear equations

DYN. CONTIN. DISCRET. IMPULS. SYST. SER. B: APPL. ALGORITHMS, 22, 163-197

K.E.M. Church and R.J. Smith?

2015

Analysis of piecewise-continuous extensions of periodic linear impulsive differential equations with fixed, strictly inhomogeneous impulses

DYN. CONTIN. DISCRETE IMPULS. SYST. SER. B: APPL. ALGORITHMS, 21, 101-119

K.E.M. Church and R.J. Smith?

2014

Research monographs

Bifurcation theory of impulsive dynamical systems

SPRINGER NATURE

K.E.M. Church and X. Liu

Release TBA

Refereed conference proceedings and theses

Invariant manifold theory for impulsive functional differential equations with applications

DOCTORAL THESIS, UNIVERSITY OF WATERLOO

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June 2019

Linearization and local topological conjugacies for impulsive systems

IN: KILGOUR, D.M., KUNZE, H., MAKAROV, R., MELNIK, R., WANG, X. (EDS.) RECENT ADVANCES IN MATHEMATICAL AND STATISTICAL METHODS: IV AMMCS INTERNATIONAL CONFERENCE, WATERLOO, CANADA, AUGUST 20–25, 2017

K. E.M. Church

August 2018

A new measure of robust stability for linear ordinary impulsive differential equations

IN: BÉLAIR J., FRIGAARD I., KUNZE H., MAKAROV R., MELNIK R., SPITERI R. (EDS) MATHEMATICAL AND COMPUTATIONAL APPROACHES IN ADVANCING MODERN SCIENCE AND ENGINEERING.

K.E.M. Church

August 2016

Applications of impulsive differential equations to the control of malaria outbreaks and introduction to impulse extension equations: a general framework to study the validity of ordinary differential equation models with discontinuities in state

K.E.M. Church

MASTER'S THESIS, UNIVERSITY OF OTTAWA

December 2014

Non-refereed contributions

User manual and tutorial for ISIM1s: a tiny MATLAB package for single stage invariant manifold-guided impulsive stabilization of delay equations

K.E.M. Church

ARXIV.ORG/ABS/1912.07766

2019

Invited talks and conference presentations

CRM-CAMP in Nonlinear Analysis Seminar Series

Montreal, Canada

TITLE: "RIGOROUS COMPUTATION OF PERIODIC SOLUTIONS AND FLOQUET MULTIPLIERS IN DELAY DIFFERENTIAL EQUATIONS WITH TIME-FORCED DISCONTINUITIES"

October 13, 2020

CRM Applied Mathematics Seminar

Montreal, Canada

TITLE: "IMPULSIVE DELAY DIFFERENTIAL EQUATIONS: INVARIANT MANIFOLDS, BIFURCATIONS, CONTROL AND NUMERICS"

February 24, 2020

SIAM Conference on Applications of Dynamical Systems

Snowbird, Utah

TITLE: "CENTRE MANIFOLDS FOR IMPULSIVE DELAY DIFFERENTIAL EQUATIONS: APPROXIMATION AND APPLICATIONS"

May 19 – 23, 2019

WICI Graduate Fellowship Awardee Research Symposium

Waterloo, Ontario

TITLE: "THE HIDDEN GEOMETRY OF COMPLEX DYNAMICS AND HOW TO EXPLOIT IT"

February 12, 2019

The IV AMMCS International Conference

Waterloo, Ontario

TITLE: "LINEARIZATION AND TOPOLOGICAL CONJUGACIES FOR IMPULSIVE SYSTEMS"

August 20 – 25, 2017

The 10th Annual Ottawa Mathematics Conference

Ottawa, Ontario

TITLE: "UOTTAWA DISTINGUISHED STUDENT PAPER LECTURE: CONTROL OF MALARIA IN THE PRESENCE OF INSECTICIDE-RESISTANT MOSQUITOES"

June 16 – 19, 2017

The 9th Annual Ottawa Mathematics Conference

Ottawa, Ontario

TITLE: "BIFURCATIONS IN IMPULSIVE DIFFERENTIAL EQUATIONS"

June 2016

The 2015 AMMCS-CAIMS Congress

Waterloo, Ontario

TITLE: "A NEW MEASURE OF ROBUST STABILITY FOR IMPULSIVE DIFFERENTIAL EQUATIONS"

June 7–12, 2015

2013 CMS Winter Meeting

Ottawa, Ontario

TITLE: "A COMPARISON OF TWO MALARIA VECTOR CONTROL STRATEGIES WITH IMPULSIVE DIFFERENTIAL EQUATIONS"

December 6–9, 2013

Canadian Undergraduate Mathematics Conference 2011

Québec, Québec

TITLE: "MODELLING BIOLOGICAL PHENOMENA WITH IMPULSIVE DIFFERENTIAL EQUATIONS"

June 15 – 19, 2011

Supervision and mentorship

Undergraduate Summer Research Project

McGill University

CO-SUPERVISOR/PROJECT COORDINATOR

Summer 2020

- Co-supervised with Jean-Philippe Lessard a student during the Summer 2020 term.
- The student worked on a project I proposed and oversaw, titled “Computer-assisted methods for periodic orbits in vibrating gravitational billiards”. The research they completed was submitted for publication.

CÉGEP Supervision Program

McGill University

SUPERVISOR/PROJECT COORDINATOR

Winter 2020

- Supervised three CÉGEP (pre-university) students on a winter term research project.
- The project I developed, titled “Mechanisms of seasonality of infectious diseases and their interaction with vaccination strategies”, required the students to complete independent reading, solve a problem in infectious disease modelling and control policy, give a presentation to their peers and write up a report.

Conference sessions organized

Applications and Recent Developments in Discontinuous Dynamical Systems (CMS Winter Meeting 2020, Montreal, Canada)

Workshops attended

Connections in Infinite Dimensional Dynamics (May 18 – 22, 2020, Banff, Canada)

Rigorous Computational Dynamics in Infinite Dimensions (April 3 – 6, 2019, Montreal, Canada)

Service

2018 - 2019 **Chair**, Applied Mathematics Graduate Colloquium (University of Waterloo)

2018 **Chair**, Dynamical Systems and Stability Group [students of Dr. Xinzhi Liu] (University of Waterloo)

2018 – **Reviewer**, MathSciNet Reviews

Journal Referee, Nonlinear Analysis, SIAM Journal on Control and Optimization, Nonlinear

2014 – Analysis: Hybrid Systems, Journal of Applied Mathematics, IEEE Access, AIMS Bioengineering,

Applications of Mathematics, Kragujevac Journal of Mathematics, Control and Cybernetics

Professional Affiliations

2018 – **Early Career Membership**, Society for Industrial and Applied Mathematics

2016 – **Introductory Member**, American Mathematical Society

2012 – **Standard Member**, Society for Mathematical Biology