M-Phimac: Master's in Financial Mathematics at McMaster

MASTERS ■ PHIMAC

McMaster University

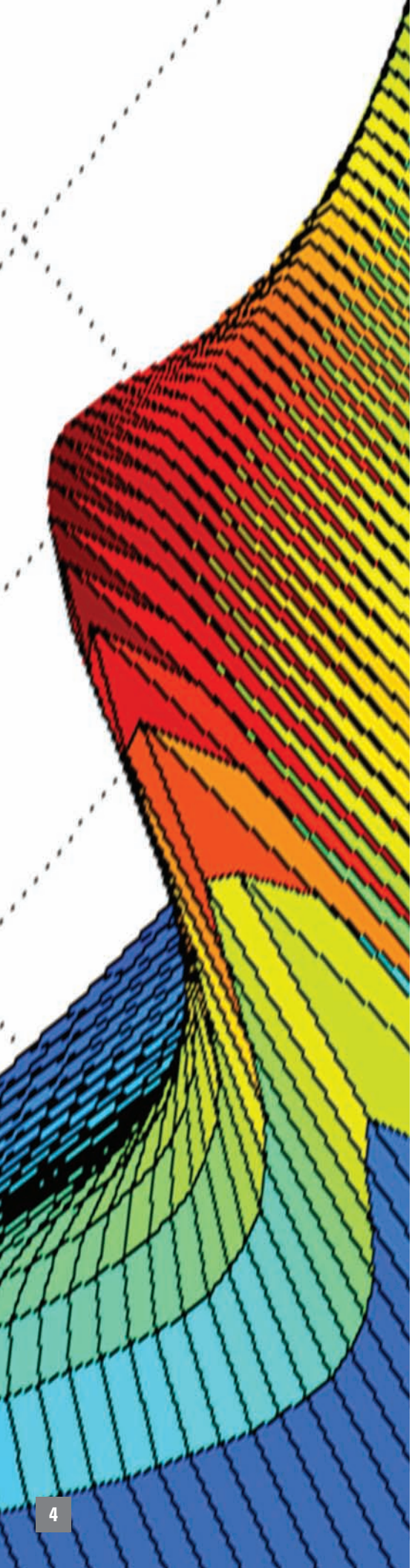
Contact Information

Phimac
Department of Mathematics and Statistics
Hamilton Hall 402
1280 Main Street West
Hamilton, ON L8S 4K1
Canada

905.525.9140 x 27103
905.522.0935 (fax)

email@Phimac.org
www.Phimac.org

Contents



About M-Phimac

Banking and Investment are two fields that offer a wide range of exciting career opportunities to ambitious, quantitatively minded people. M-Phimac, the coursework M.Sc. program offered by the Mathematics and Statistics Department at McMaster University, is for the student who wants a fast track to a finance industry career in the areas of risk management, derivative securities analysis and portfolio design. After completing eight specialized grad courses in eight months, plus a number of optional training activities, you will be well prepared to go after one of many opportunities available in banking, insurance and the investment business.

What is it?

M-Phimac is an M.Sc. program completed in eight months by taking 4 graduate level courses in each of two terms. The program emphasizes the development of strong mathematical foundations for finance, but also gives time to explore the practical aspects of markets. The goal is to understand the applications of mathematics to finance and investments by developing a solid understanding of the underlying theory.

Who is this for?

This program targets ambitious new and recent graduates in mathematics, or related subjects such as statistics, physics, computer science, and engineering, who are interested in a career in finance. Successful applicants will have a minimum B+ average across their level 3 and 4 undergraduate courses, or the equivalent standard from another university. Beyond academic achievement, other key indicators of potential success in the program are analytical expertise, excellent communication skills and computer programming capability.

What will you gain?

You will have a competitive advantage in exciting careers in the expanding quantitative finance industry. Having mastered sophisticated mathematical techniques, and having gained a deep understanding of valuing financial securities, you will have the confidence to face the challenging interview process that marks the entrance into the finance profession. You will be prepared to start a career as a quant working on financial modeling, risk management, or as a trading analyst. Quantitative career paths accessible to our graduates are also expanding in the insurance and investment management industries.

Phimac, the Department, and McMaster University

Established in 1999, Phimac – the Financial Mathematics laboratory at McMaster – is a group of faculty, postdoctoral fellows and graduate students working on the theory and practice of financial mathematics, including derivative pricing models in complete and incomplete markets, credit risk modeling, statistical properties of financial time series, interest rate models, and portfolio risk management. More generally, we are interested in problems from all areas of industrial mathematics. We welcome contact from partners in industry and academia who face challenges in finance or other industrial areas that have a mathematical, statistical, or computational foundation.

The Department:

The Mathematics & Statistics department at McMaster University is a large-sized department of 38 regular faculty, 15 post-doctoral fellows and 83 graduate students.

Research seminars in Algebra, Analysis, Applied Math, Finance, Geometry and Topology, and Statistics and the weekly Colloquium attract some of the world's most prominent mathematicians.

The department is well-known throughout the world mathematical community for the high quality of research in many areas of mathematics and statistics. A 2000 survey by OST ranks McMaster third among Canadian mathematics departments based on the impact of published research in our department.

Facilities:

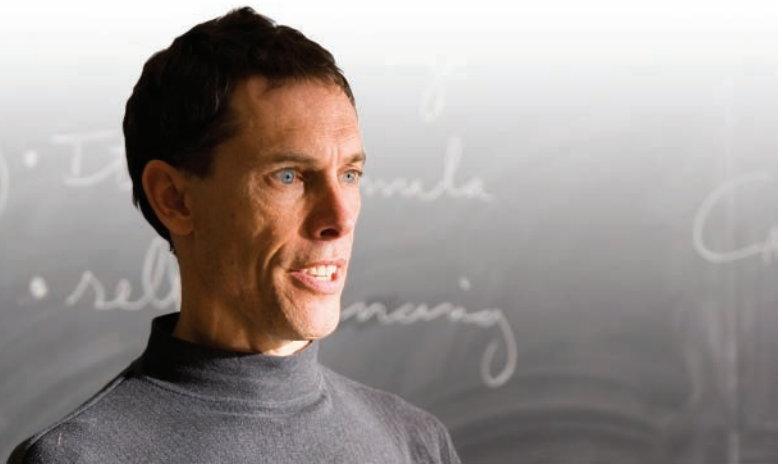
The Department of Mathematics and Statistics is located in the James Stewart Centre for Mathematics, located in McMaster's historic Hamilton Hall, providing agreeable space for the faculty and graduate students. A "Math Café" on the main floor provides a natural setting for informal meetings. Hamilton Hall is located in the centre of campus and affords panoramic views of the forested area which borders the scenic McMaster campus.

McMaster University:

McMaster University, located in Hamilton, Ontario, is a mid-sized, research intensive university with approximately 2250 graduate students and 15100 undergraduates. The University is located in West Hamilton on an attractive campus measuring 296 acres beside the Royal Botanical Gardens.

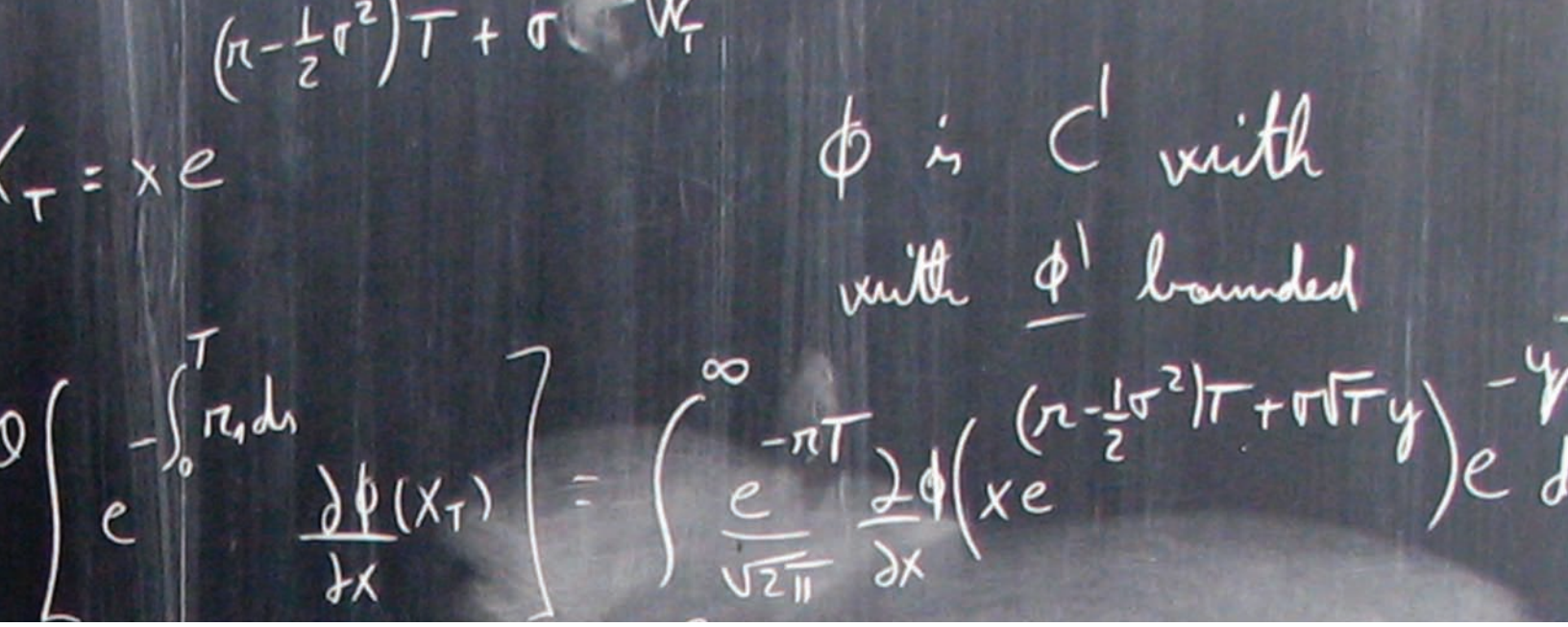
Faculty

The core financial math courses of our program are taught by the following faculty members:



Tom Hurd is Professor of Mathematics at McMaster, and in 1999 founder of Phimac. After a lengthy research career in mathematical physics he turned to the mathematical study of financial markets in the late 1990s. Since then he has built an international research reputation, with many publications in portfolio theory, interest rate modeling, and credit risk. He has supervised numerous M.Sc. and Ph.D. students in financial mathematics over the years, many of whom currently work in banking, and now he welcomes the new challenges that come with teaching in the M-Phimac program.

Matheus Grasselli is the Sharcnet Chair in Financial Mathematics and co-director of PhiMac. After obtaining a doctorate in mathematical physics from Kings College London, he has been working in mathematical finance and is an experienced instructor of undergraduate and graduate mathematics, supervising numerous research projects in both theoretical and practical aspects of finance, risk management, and investment strategies. Dr. Grasselli has published many research papers, contributed to texts and articles, and is a regular speaker in both academic and industrial conferences around the world.



David Lozinski recently returned to teach at McMaster University after having worked over 10 years in the banking industry in a variety of quantitative roles. He established a team responsible for mathematical models for global credit risk, and has worked with fellow banking leaders to produce Canada's responses to new model-based international banking regulations. He has extensive experience in the mathematical modeling and analysis of credit risk, including work in economic capital, CDO analysis, and the validation of pricing and hedging models for exotic derivatives. Dr. Lozinski brings his passion for teaching and his wide industry experience to McMaster University to prepare PhiMac students to land successful careers in finance.

Ian Buckley is very pleased to return to Canada this year to join Phimac as a Sessional Lecturer and Visiting Professor. Following his PhD in Theoretical Physics from Imperial College, he moved to mathematical finance, joining the London office of the risk management software and consulting firm BARRA International as a Research Consultant. Later, he returned to academic work, holding positions at Imperial College and King's College London. During the past decade he has taught undergraduate, masters and doctoral courses on topics including stochastic differential equations, financial markets, and mathematical methods for derivative pricing, and has supervised research projects at MSc and PhD levels.

Application Procedure

Every M-Phimac applicant is asked to complete an Online Application found at **www.math.mcmaster.ca/graduate/application.php** and to supply the following required documentation:

1. One official/notarized transcript of academic work done to date, sent directly from the issuing institution. If the final transcript does not show that a completed degree has been conferred, an official/notarized copy of your diploma is also required..

2. Two confidential letters of recommendation from instructors most familiar with your academic work. Recommendations must be provided directly from the instructors.

3. If English is not your native language, an official copy of your TOEFL score (minimum score 580, or 237 on computer test).

4. Payment of the non-refundable application fee. The amount is $90 Canadian dollars if paid by credit card, and $105 if paid by cheque or by money order. Please make cheques payable to “McMaster University”.

Please arrange to have all required documentation sent to:

Graduate Admissions
Department of Mathematics & Statistics
McMaster University
1280 Main Street West
Hamilton, Ontario
L8S 4K1 Canada

The deadline for September admission is February 1.

If you have any questions, please contact the Math Grad Advisor.

Fees

The fees for this 8 month program are approximately:

- Canadian: $5700
- Visa: $13000

Core Courses

The following 7 courses are required:

Math 771: Mathematics of Finance

Stochastic calculus, martingales and arbitrage, Black-Scholes equation and pricing derivative securities, fundamental theorems of asset pricing, models of equity and fixed income markets, exotic options.

Math 772: Financial Markets

Overview of equity, fixed income and FX markets; summary of continuous time financial modelling; pricing of vanilla and exotic derivatives; financial time series, GARCH models; discussion of volatility; market risk, VaR, CAPM models; introduction to credit risk; capital models.

Math 773: Applied Computational Finance

Lattice methods: binomial trees; Monte Carlo methods; numerical methods for parabolic PDEs; applications to option pricing and risk measurement.

Math 774: The Mathematics of Credit Risk

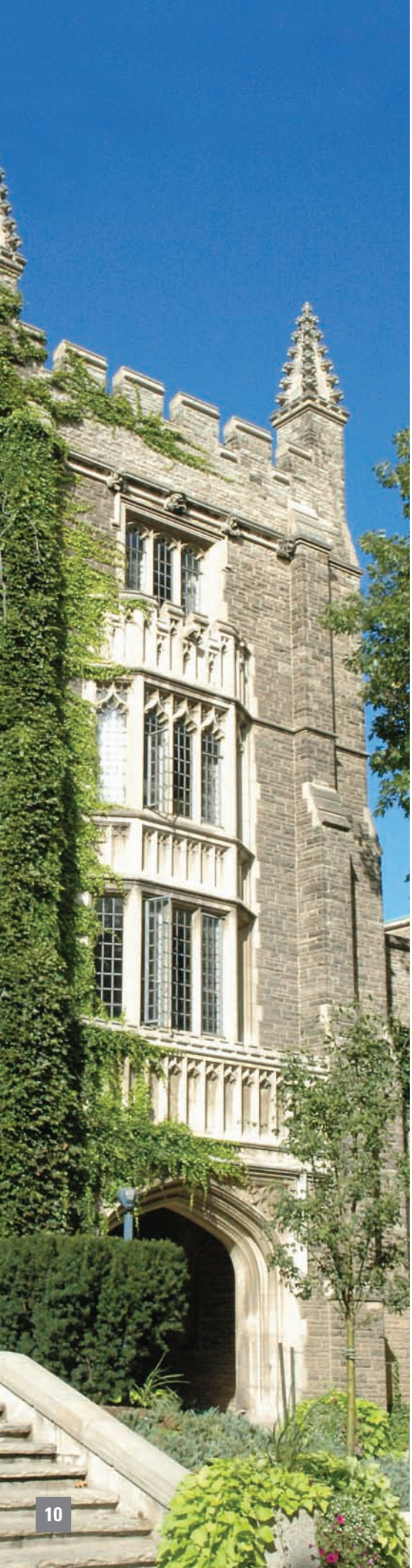
Default events and stopping times; bonds and rates; credit spreads and corporate bond prices; intensity based models; credit rating models, firm value models; default correlation; credit derivatives; calibration; basket credit products; collateralized debt obligations.

Math 775: Portfolio Theory and Incomplete Markets

Semimartingale market models; trading strategies; wealth processes and stochastic integration; risk aversion; utility theory of consumption and wealth; solution of Merton's problem; pricing and hedging in incomplete markets; markets with stochastic volatility; transaction costs; Levy markets

Stats 743 (full year, counts as two courses): Foundations of Statistics

A systematic treatment of the central concepts and methods of statistical inference, including sampling distributions, point and interval estimation, and testing of statistical hypotheses.



Elective

In addition, students are required to choose one elective from the list below:

Math 6K03: Mathematics of Finance

Options and forwards, efficient market hypothesis, no arbitrage condition, binomial asset pricing model, portfolio strategies, stochastic processes, conditional expectation, martingales, optimal portfolio selection, exotic options, stochastic interest rate models.

Math 6A03: Real Analysis

Metric spaces, compactness. Spaces of continuous functions, functions of several variables, inverse and implicit function theorems. Lebesgue integration.

Stats 6D03: Intermediate Probability Theory

Construction of probability spaces and random variables, integration, conditional expectation, law of large numbers, convergence of series, weak convergence, characteristic functions and central limit theorems, martingales.

Math 742: Applied Mathematics II

Partial differential equations: elliptic, parabolic, and hyperbolic equations using distributional, integral equation, and variational methods, and non-linear problems.

Stats 754: Stochastic Processes and Applications

Review of probability methods for applied scientists: functional transformations, convolution, correlation, power spectra density, Monte Carlo methods, Markov processes, queuing theory.

CES 702: Advanced Computational Methods and Models

Advanced topics in scientific computing, including iterative sparse methods and direct sparse methods for linear systems, QR-type algorithms for computing eigenvalues, perturbation analysis, methods for large-scale ODE systems, choice of preconditioners, Newton-Krylov methods for solving nonlinear systems, introduction multigrid methods, automatic differentiation, and sensitivity analysis.

Econ 721: Microeconomic Theory I

This course covers basic graduate-level microeconomic theory, including constrained optimization, theory of the household and the firm, decision-making under uncertainty, and general equilibrium analysis.

Econ 761: Econometrics I

Topics include linear regression and generalized least squares.

"When I started my career as a risk analyst, I was very pleased to find out that the knowledge and skills I obtained as a Phimac graduate were very relevant for the tasks before me. I felt confident and ready for the challenge."

Lingling Wang, Arrow Hedge Partners Inc.

"Having been involved over the years with Phimac researchers at McMaster, I know the quality of preparation these students receive. Our hedge fund needs quantitatively minded people who also know how the real world works: I believe the M-Phimac program is excellent preparation."

Jeff Boland, Millennium Management, LLC, New York

Department of Mathematics and Statistics
Hamilton Hall 402
1280 Main Street West
Hamilton, ON L8S 4K1
Canada

905.525.9140 x 27103
905.522.0935 (fax)

email@Phimac.org
www.Phimac.org