

Mathematics

Stochastics & Financial Mathematics

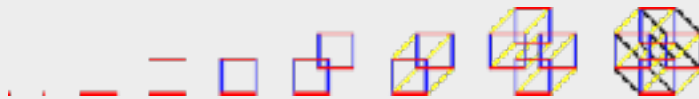
UvA Faculty of Science

Why Mathematics?

Best jobs according to Wall Street journal (2014):

1. Mathematician
2. Actuary
3. Statistician

“Math skills unlock a world of career opportunities”



- **Risk manager** SNS financial markets
- **Innovator** at TNO
- **PhD candidate** at UvA
- **Consultant** at Hypercube Business Innovation
- **Portfolio manager** Renewables at Statkraft
- **Mathematics Teacher** at Berlage Lyceum
- **Consultant Advanced Analytics** at Deloitte Consulting
- **Program manager** at ProRail
- **Researcher** at Centraal Bureau voor Statistiek
- **Data Scientist** at Xomnia



SNS REAAL



UvA-alumni that started their Master in 2014 **Where are they now?**

14 Mathematics + **9** Stochastics & Financial Mathematics

7: University (*Netherlands, UK, Germany, Spain*)

1: High school (*Ichthus Lyceum*)

3: Banks (*ING, ABN AMRO, Rabobank*)

3: Consultancy companies

(*FormsVision, RiskQuest, Marsh & McLennan*)

2: Investment companies (*NLII, HAL Investments*)

1: Insurance company (*WZW insurances*)

1: Energy company (*Alliander*)

3: just finished the master

2: unknown

Master Programmes

- Mathematics (**120EC**): research variant and variant with minor or major.
- Stochastics and Financial Mathematics (**120EC**).
- Double Master Mathematics & Theoretical Physics (**180EC**).
- Double Master Mathematics & Econometrics (**150EC**).
- Double Master SFM & Econometrics (**150EC**).

Research variant master Mathematics and master SFM in collaboration with the Free University of Amsterdam.

Master mathematics with major or minor

Focus: mathematics in industry, society and education.

With 60EC major: 36EC courses, 24EC master project.

Majors: Science in Society,
Teaching (in dutch),
Science Communication (in dutch).

With 30EC minor: 6EC master seminar, 60EC courses,
24EC master project.

Minors: Tesla,
Science for Sustainability.

Master mathematics (research variant)

Four tracks:

- Algebra & Geometry
- Mathematical Physics
- Analysis & Dynamical Systems
- Stochastics

Characteristics: master seminar, mastermath, master project.

Structure of the programme

- **6 EC: Master Seminar**
- **66 EC: Mathematics courses**
 - ~ 36 EC within your track / programme
 - at least 2 advanced courses
 - ~ 30 EC free within mathematics
- **12 EC: Free programme**
- **36 EC: Master Project**

Structure of the programme

	<i>Fall</i>	<i>Spring</i>
<i>Year 1</i>	<i>Master Seminar</i> <i>basic courses</i>	<i>Master Seminar</i> <i>basic courses</i> <i>advanced courses</i>
<i>Year 2</i>	<i>advanced courses</i>	<i>Master Project</i>

Master Seminar (new since 2016)

Three seminars, per track/subject:

- **Algebra, Geometry & Mathematical Physics**
- **Analysis & Dynamical Systems**
- **Stochastics** (including SFM)

The first link with mathematical research in Amsterdam!

Master Seminar (new since 2016)

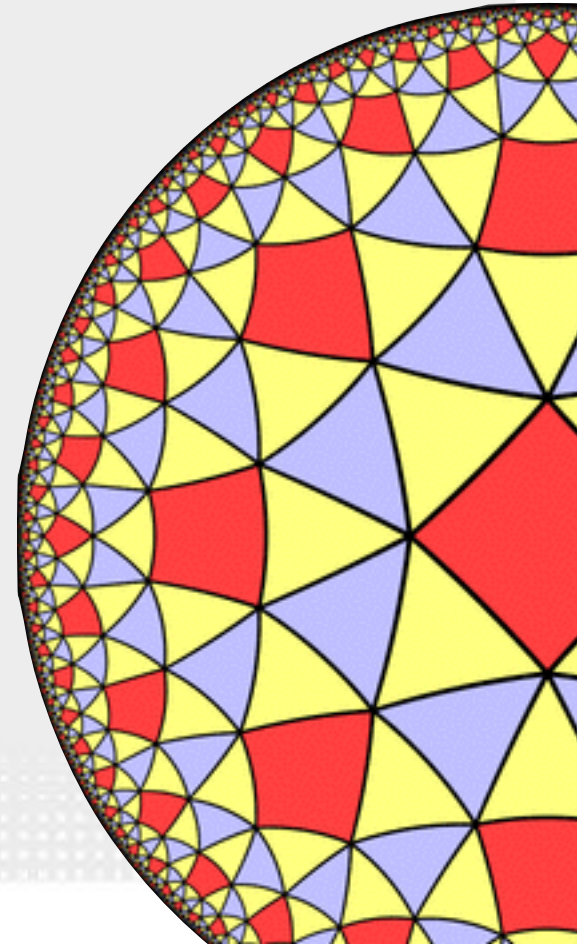
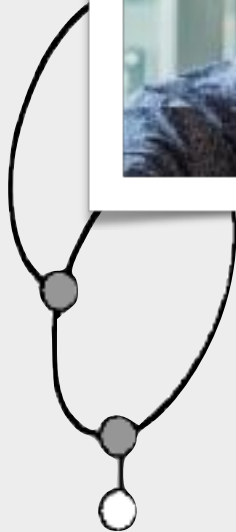
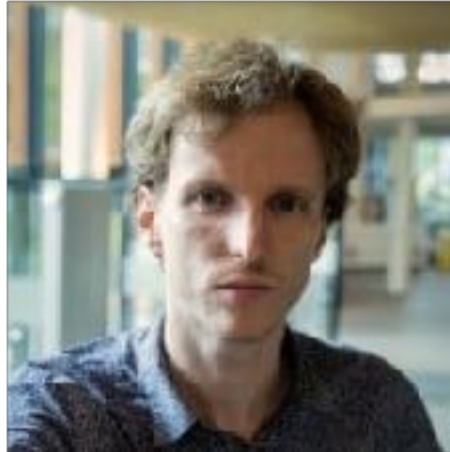
Lectures by:

- 1st year students on research books or papers
- staff and PhD students on their research
- 2nd year students on their Master Project
- Alumni



Algebra, Geometry & Mathematical Physics

Eric Opdam & Lenny Taelman



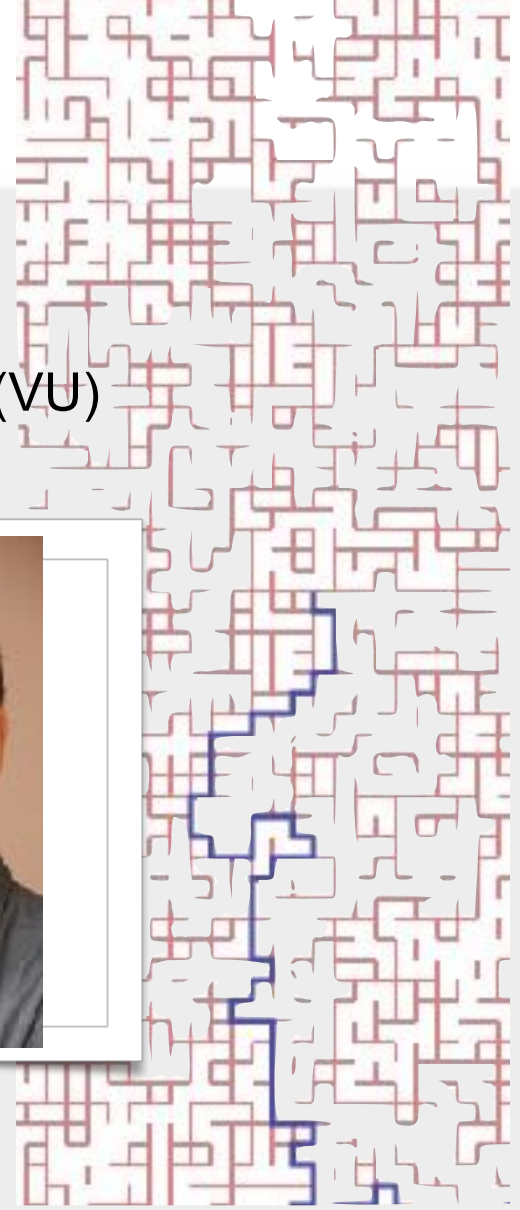
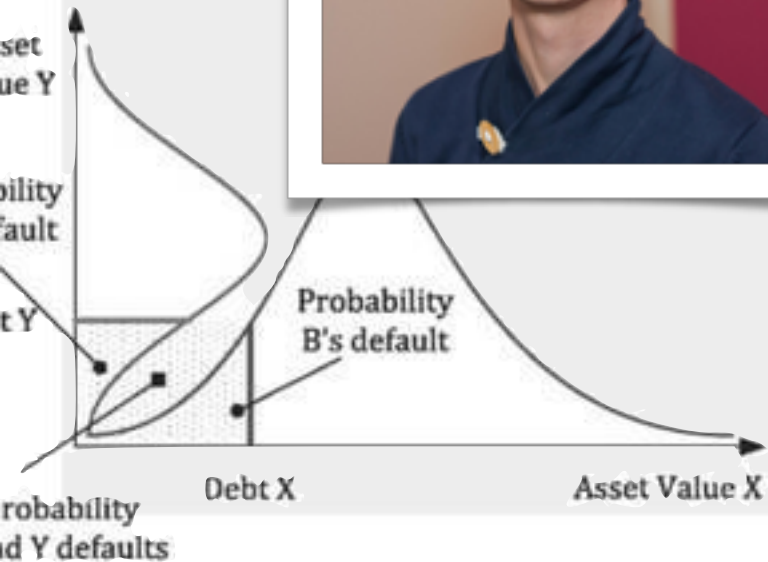
Analysis & Dynamical Systems

Han Peters & Jan Bouwe van den Berg (VU)



Stochastics

Arnoud den Boer & Ronald Meester (VU)



Courses: Algebra & Geometry 17/18

Basic courses

- *Algebraic Topology*
- *Algebraic Geometry 1*
- *Quivers*
- *Differential Geometry*
- *Algebraic Number Theory*
- *Commutative Algebra*

Advanced courses

- *TFT and Moduli Spaces*
- *Mirror Symmetry*
- *Poisson Geometry*
- *Advanced Algebraic Geometry*

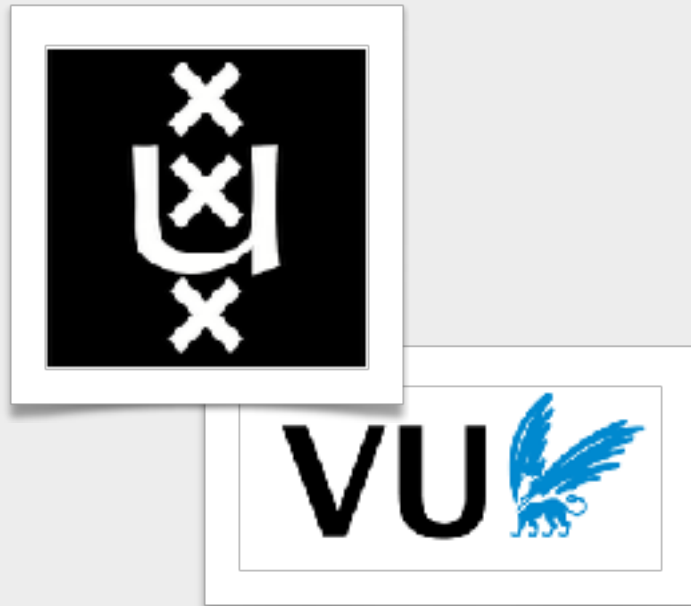
Basic courses

- *Lie Groups and Lie Algebras*
- *Riemann Surfaces*
- *Elliptic Curves*
- *Topology in Physics*
- *Operator Algebras*
- *Algebraic methods in combinatorics*

Advanced courses

- *Algebraic Geometry 2*
- *Quantum Groups*
- *Algebraic Topology 2*

Local courses



- at UvA or VU
- topics with local signature
- taught by leading experts

Mastermath



- mostly in Amsterdam or Utrecht
- focussed on basic subjects

Local course: TFT and Moduli Spaces



- Sergey Shadrin (UvA)
- **Algebra & Geometry, Mathematical Physics**
- Prerequisites: Algebraic Topology & Differential Geometry (Mastermath)

Local course: Finite Element Methods for Partial Differential Equations



- Rob Stevenson (UvA)
- **Analysis & Dynamical Systems** track
- Prerequisites: Functional Analysis (Mastermath or bachelor).

Local course: Queues and Levy Fluctuation Theory



- Michel Mandjes (UvA)
- **Stochastics** track & **SFM**
- Prerequisites: Measure Theoretic Probability & Stochastic Processes (Mastermath)


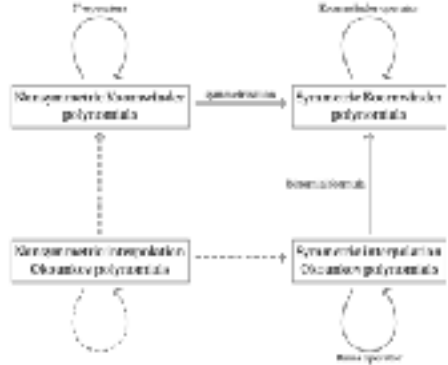
Master project (36EC)


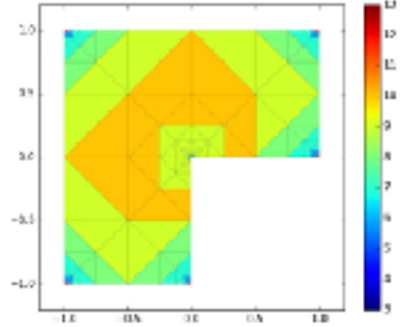
Individual literature research in mathematics.
Related to open research problems.

- * Under supervision of a staff member of the Korteweg-de Vries Institute for Mathematics.
- * Possibility to combine with internships (master SFM).

The second link with mathematical research in Amsterdam!



N. Dieveld	Master programme: Mathematics		October 25th, 2017
Institute: UvA / Other	Research group: Korteweg-de Vries Institute for Mathematics	Graduation thesis	Supervisor: Jasper Stokman
	<p>Nonsymmetric Interpolation Okounkov Polynomials</p> <p>There exist (non-)symmetric interpolation polynomials that are connected to the famous (non-)symmetric Macdonald polynomials. With Laurent polynomials, the role of the (non-)symmetric Macdonald polynomials is being played by the (non-)symmetric Koornwinder polynomials. There exist symmetric interpolation Laurent polynomials that are connected to the symmetric Koornwinder polynomials, we give a new proof of this existence. Also, we give a definition of the non-symmetric interpolation Laurent polynomials that are connected to the non-symmetric Koornwinder polynomials and prove their existence.</p>		
<p>Scientific abstract (pdf 1K) For more info or full text, mail to: j.v.stokman@uva.nl</p>			

J.H. Westerdiep	Master programme: Mathematics		June 27th, 2017
Institute: KdV	Research group: Dynamical Systems and Numerical Analysis	Graduation thesis	Supervisor: Rob Stevenson
	<p>Two-dimensional hp-adaptive finite elements in theory and practice</p> <p>Partial differential equations (PDEs) describe many processes in nature, from the flow of water to the shape of a soap bubble. Often, it is hard (or even impossible) to find the function that solves such a PDE. In such cases, one looks for numerical solutions that approximate the true solution. In this thesis, we look at a finite element method: The domain of the function is partitioned into a large number of elements—in our two-dimensional case, we will subdivide a polygon into triangular elements. Endowing each triangle with a fixed polynomial degree, our finite element method aids in finding an approximate solution to the PDE that is continuous globally, and a polynomial on each triangle locally. Given such an approximate solution, we often want to refine some of the triangles into smaller ones, so that we may construct a better solution on this refined grid. In this thesis, we analyse a novel algorithm for an even more complex case—hp-adaptive finite elements—where we allow increasing the polynomial degree on each triangle separately. We will prove that, under mild circumstances, the size of the global error will decay exponentially in the total number of degrees of freedom.</p>		
<p>Scientific abstract (pdf 1K) For more info or full text, mail to: r.p.stevenson@uva.nl</p>			

More examples: [Science in Progress](#)

Master Stochastics & Financial Mathematics


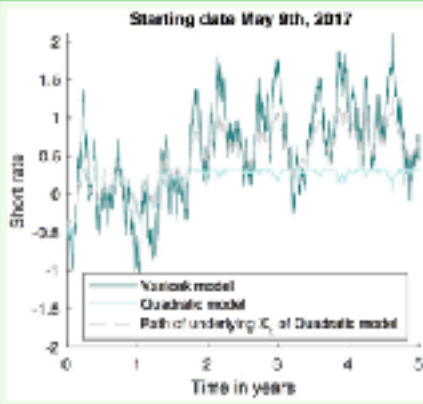
Focus: Stochastics and its applications, in particular in Financial Mathematics.


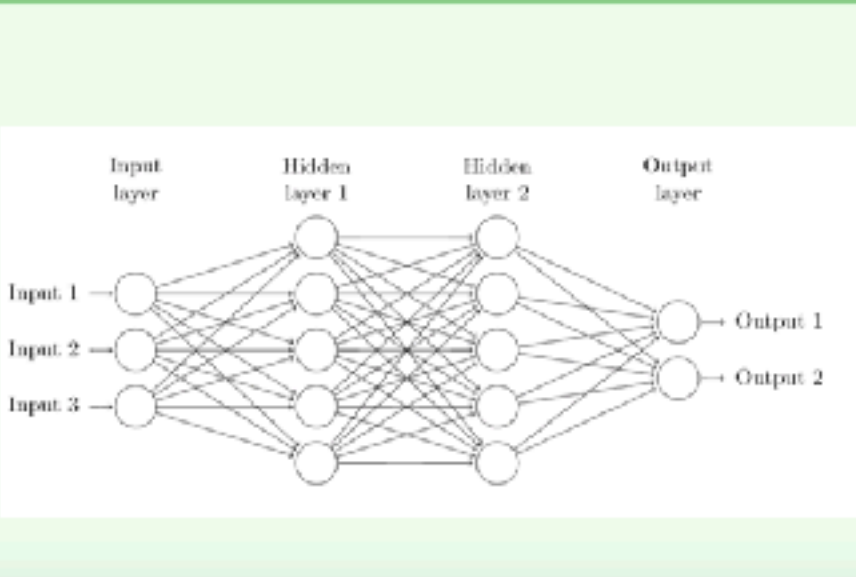
Structure: the same as the research variant of the master Mathematics, including the three main characteristics: *master seminar, mastermath, master project*.

Additional characteristics:

- * Many international students.
- * Master projects combined with internships (banks, consultancy agencies, insurance companies).



I.S. Liesker	Master programme: Stochastics and Financial Mathematics	August 22nd, 2017
Institute: KdVI	Research group: Stochastics and Financial Mathematics	Graduation thesis Supervisor: Peter Spreij
	<p>Affine and quadratic interest rate models: A theoretical and empirical comparison</p> <p>In the financial world people try to speculate about the financial market. There are many variables that are unknown and that one wants to describe by, for example, stochastic models. These models help to get insight in the financial variables and are sometimes even used to predict the future development of the variable in order to do proper investments or protect themselves against risk. The latter, in form of interest rate risk modeling, is studied in this thesis. One of the popular interest rates models is the affine model. Affine models are becoming increasingly popular due to their analytical and computational tractability. Affine processes have a nice pricing formula for multiple financial products. Quadratic processes are, to some extent, an extension of affine models and have similar properties as affine models. This thesis compares these affine and quadratic models on a theoretical and an empirical level. For the theoretical level, the mathematics of affine and quadratic interest rate models is explained. For both affine and quadratic models analytical ('nice') formulas for some financial products are provided using admissible parameters and Riccati equations. Also, using the analytical bond prices, a small empirical comparison is performed where some computational examples are discussed.</p>	<p>Starting date May 9th, 2017</p> 
Scientific abstract (pdf 1K) Full text (pdf 3B61K)		

R.Q. Riksen	Master programme: Stochastics and Financial Mathematics	August 22nd, 2017
Institute: KdVI	Research group: Stochastics and Financial Mathematics	Graduation thesis Supervisor: Peter Spreij
	<p>Using Artificial Neural Networks in the Calculation of Mortgage Prepayment Risk</p> <p>A client with a mortgage loan has the possibility to pay back part of his mortgage before the end of the contract. Because this poses a risk to the bank due to the loss of future interest payments, it is very important to predict the probability that a client will prepay on his mortgage. There are many parameters that can influence these mortgage prepayments in a complicated way. Artificial neural networks are used as approximators. A network consists of many connected nodes, that are grouped into layers. Each node takes a weighted sum of all the input it receives, applies a certain function to it and sends it on to all neurons in the next layer. The key to making a neural network approximate the target function, is to make it 'learn' the correct weights. It gets to see a lot of input values and makes predictions. If the prediction was incorrect, all weights are changed a little in the direction that will make the network give a better prediction next time. This way, the network learns by making mistakes. In this thesis at ABN AMRO, we explore</p>	

Double Master Mathematics & Theoretical Physics (180EC)

- **Goal:** bilinguality in research in both mathematics and theoretical physics.
- **Entry requirements:** double bachelor Mathematics + Physics
- **Joint course:** *Topology in Physics*
- **Integrated Master Project (72EC):** advisors from mathematics and physics.

Master Mathematics: practical matters

Entry requirements: Bachelor Mathematics,
Proficiency in English.

Start: February or September.

Application: via studielink.nl and datanose.

Application deadline: December 1 for February enrolment,
May 1 for September enrolment.

More information:

<http://gss.uva.nl/content/masters/mathematics/mathematics.html>

Master SFM: practical matters

Entry requirements:

Bachelor Mathematics and bachelor Econometry, including Measure Theory, Probability and Statistics.
Proficiency in English.

Start: September.

Application: via studielink.nl and datanose.

Application deadline: May 1.

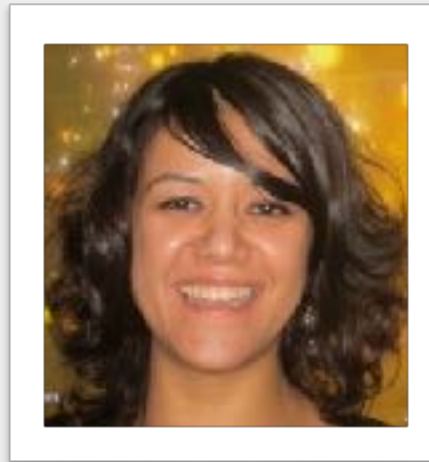
More information:

<http://gss.uva.nl/content/masters/stochastics-and-financial-mathematics/stochastics-and-financial-mathematics.html>

For more information...



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Jasper Stokman
director
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What's next?

- Talk to people! (coordinators, students, ...)
- Talk to student advisor Anja Zoomers and students Luuk Stehouwer and Gideon Jager on the Information Market.
- Online course info: <http://www.studiegids.uva.nl>
- Get a copy of the presentation from my website <https://staff.fnwi.uva.nl/j.v.stokman/>

Listen to the alumnus: Simon Koolstra!