



# Robert Fitzner

Mathematician with wide background and advanced programming experience



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**Researcher:** high-level research for 10 years in an international environment. Doing independent work on theoretical topics as well as projects in interdisciplinary teams resulting in techniques applied in practice.


Keywords: stochastic modeling, random processes, risk modeling, large deviation, algorithms, criticality systems

**Developer:** Started coding 23 years ago with Perl and early 3D-programming. Student job as system administrator (maintain Unix/SunOS/Solaris systems). Use JAVA within research and JavaScript to create interactive animations.

Keywords: Java, JavaScript, Perl, C++, SQL, bash, HTML, CSS, Wordpress, Mathematica

The minors subjects of my **study** were accounting, auditing, financing and software engineering & databases



- TU/e** Researcher, TU Eindhoven & ICMS since 2015
-  Researcher, Stockholm University 2013-2015
- TU/e** PhD Student, TU Eindhoven&EURANDOM 2008-2013  
Degree: PhD mathematical physics
- FV B** System administrator (student job), 2005-2008  
Forschungsverbund Berlin
- TU** Student of mathematics, TU Berlin Degree: 2005-2008  
Master (math.oec.diplom)

## Experiences



Training in **financial mathematics**: risk assessments, performance measurements and pricing replication, differential equations and Monte-Carlo simulations



Specialist in an **inter-disciplinary team**. As mathematician I played a central role in the experimental design(selection of experiments to perform) and the processing of the measurements



One large project that lasted 9 years, in which I researched independently in the field of statistical physic. This resulted in three 80+ page articles and one 300 page-thesis.



**General editor** and coordinator for a project that manages a website promoting research. We started the site 2016 and created a steady stream of articles& blogs since then.



**Developer** of simulations for models in statistical physics to numerically analyze them and create animation/visualization of these models [www.fitzner.nl/simulator](http://www.fitzner.nl/simulator).



Created and **lectured** bachelor and master courses with 20-80 students, most of them on financial mathematics.



**Supervision** of bachelor and master projects on topics of vector auto-regressive models, data analysis and machine learning



**Sailing** experience shore and offshore. Usually with a 4-8 men crew. I have been skipper for about half of the tours.

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I have worked on problems in various fields, such as probability theory, statistical physics, chemistry and mathematical finance:

## **Financial Mathematics**

The major of my study was financial mathematics, quantitative finance. In my diplom/master's thesis I created a scheme to price derivate on traded stocks. The challenge thereby was to derive a pricing scheme when the trading strategies (used to hedge the option) are restricted. Since 2013 I regular gave courses in financial mathematics treating topic such as asset price, risk and performance evaluation and fixed income streams.

## **Projects with ICMS**

In three projects I assisted chemists from the Institute for Complex Molecular Systems (ICMS) in their research. The common aim of these projects was to understand the chemical reactions of particles/proteins that can only be measured poorly due to their size or the concentration. To overcome this limitation I introduce a combination of simulation and mathematical modeling with selected experiments. Using this idea we could exclude conjectured mechanism and create evidence to the real workings of these systems. This idea of clever experimental design and simulation is an innovative and potent approach that we successfully used to analyze system relevant for the multiplication of DNA, infiltration of cell membranes and recombination of proteins.

## **NoBLE project**

In my PhD project I created a novel technique to analyze 4 standard models of statistical physics and solve a problem that remained unsolved for 20 years. This technique is a combination of perturbation theory, Fourier analysis, combinatorics and numerical validation. This project resulted in three 80+ page articles, which will be standard references for these model for the following decades. A summary can be found on [www.fitzner.nl/noble](http://www.fitzner.nl/noble)

## **Simulation and mathematics**

In two independent projects we derived mathematical results about two different models (random graphs and bootstrap percolation) describing how the model behave as they grow in size. Then, I used simulation of very large instance ( $10^9$  nodes for the graph) to numerically estimate the constants appearing in our mathematical results.

## **www.networkpages.nl**

This website is an outreach to promote research related to networks and is financed by the Dutch government. I am a member of the executive board and have been crucial for the launch of the website. I am one of the three general editors that coordinate and revise publications. Further, have I setup and maintain the back-end of the website. Additionally, I create interactive animation for the submitted articles, see [www.fitzner.nl/simulator](http://www.fitzner.nl/simulator).

## **Causality, not correlation**

Early 2018, we were approach by the Dutch Central office for Statistics (CBS) with the request to devise a technique to find the direction of a casual relations between multiple time series that in contrast to earlier approach should also work with relatively little data. In a small group we created a technique that is simple enough to be applied in practice and can effectively identify which signal is the cause and which is the effect (provided some knowledge of the signals).