

# Robert Fitzner

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## Personal information

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**Name:** Robert Jörg Fitzner

**Date of Birth:** 27.07.1981

**Place of Birth:** Berlin, Germany

**Citizenship:** German

## Research areas

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Percolation, Statistical Mechanical Models, Mathematical Physics, Random Graphs, Algorithms

## Professional Experience

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### Eindhoven University of Technology

*Postdoctoral Research Fellow at the Department of Mathematics*

**Eindhoven**

*09/2015–present*

### Stockholm University

*Postdoctoral Research Fellow at the Department of Mathematics*

**Stockholm**

*10/2013–08/2015*

### Eurandom / Eindhoven University of Technology

*PhD Student at the Department of Mathematics*

**Eindhoven**

*09/2008–07/2013*

## Non-academic work experience.....

### Forschungsverbund Berlin e.V.

*System administrator*

**Berlin**

*01/2005–06/2008*

System administration and user support to the accounting office.

(Unix server administration, SAP/R3 support)

## Education

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### Eurandom/Eindhoven University of Technology

*PhD July 2013*

**Eindhoven**

*10/2008–07/2013*

**Supervisor:** Remco van der Hofstad

**Thesis title:** *Non-backtracking lace expansion*

**Thesis abstract:** We extend a technique, known as lace expansion, to improve mean-field results for various models in the nearest-neighborhood setting. The grand challenge was to prove that nearest-neighbor percolation above 6 dimensions displays mean-field behavior. Currently such results are only known above 18 dimensions.

We derive the non-backtracking lace expansion (NoBLE) for percolation, self-avoiding walk, lattice trees and lattice animals. The lace expansion is a perturbation technique that requires the inverse dimension  $1/d$  to be small. The proof, that  $1/d$  is small enough to successfully perform the analysis, requires the assistance of the computer. These computations are non-trivial, so that proof that percolation shows mean-field behavior in dimension  $d$  bigger than 18, were never published.

We developed an analysis that is substantially simpler and currently proves critical mean-field be-

avior percolation in  $d > 10$ . Our numerical computations, in the form of Mathematica-notebooks, are available on my homepage.

**Berlin University of Technology**  
*dipl.math.oec. (German version of Master)*

**Berlin**  
10/2002–08/2008

**Major:** finance mathematics

**1st minor:** computer science

**2st minor:** economics (with a focus on accounting)

**Diploma thesis:**

**Title:** *Superhedging under soft constraints in discrete-time market model*

**Supervisor:** Alexander Schied

## Grants

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Magnusons fond by the Royal Swedish Academy of Science, (15.000 SEK) (2014)

Travel grand by the ESF to participate the Winder School: Spatial Models in Statistical Mechanics in Darmstadt (500 Euro) (2014)

Travel grand by the PIMS to participate the Summer School in Probability 2009 at PIMS-UBS (1100 CAD) (2009)

I received three similar grants to cover travel and lodging expenses to attend given conferences.

## Research interests

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My research interests are in the field of statistical physics and probability. I am interested in the spatial evolution of systems, such as the occurrence of phase transitions and critical phenomena. Here are some keywords about my core interests:

- random walks
- percolation
- random graphs
- stochastic (spatial) growth models

Having a solid background in programming I am also interested in algorithms. I am always looking for optimal solutions to obtain simulations of the complex systems analyzed in my research. These simulations can be used to obtain schematic representations for talks and estimates of relevant quantities.

My Master thesis(Diplomarbeit) was in the field of financial mathematicatics. In this mathematical model were used to compute the price of trading options, when the possible hedging strategies are constrained. Additionally, I taken all courses for master in business studies at the TU Berlin and obtained a minor in auditing (Rechnungslegung). <br><br>

## Publications

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### Publications

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- [1]: L. Albertazzi, D. van der Zwaag, C.M.A. Leenders, R. Fitzner and R. van der Hofstad. Probing Exchange Pathways in One-Dimensional Aggregates with Super-Resolution Microscopy. (2014), Science Magazine
- [2]: R. Fitzner and R. van der Hofstad. The non-backtracking random walk. (2013), Journal of Statistical Physics.
- [3]: R. Fitzner and R. van der Hofstad. Generalized approach to the non-backtracking lace expansion. (2017), Probability Theory and Related Fields
- [4]: R. Fitzner and R. van der Hofstad. Nearest-neighbor percolation function is continuous for  $d > 10$ , (2017), Electronic Journal of Probability
- [5]: M. Deijfen and R. Fitzner. Birds of a feather or opposites attract - effects in network modelling (2017)
- [6]: N. Feiner-Gracia, A. Olea, R. Fitzner, N. El Boujnouni, A. van Asbeck, R. Brock, L. Albertazzi. Super-resolution imaging of structure, molecular composition and stability of single oligonucleotide polyplexes (submitted 2018)
- [7]: G.E. Comi, R. Fitzner, S. Kolumbán, F.P. Pijpers, R.M. Pires da Silva Castro, R.A.J. Post, and A.J. Vromans. Causal effects of government decisions on earthquakes in Groningen (submitted 2018)

### Preprints

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- [8]: R. Fitzner and R. van der Hofstad. NoBLE for lattice animals and trees. (to appear 2019)  
Under preparation

## Selected Talks

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### Invited Talks

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Probability Seminar Essen	<b>Essen</b> 20/10/2015
Workshop: Probability and Graphs	<b>Eindhoven</b> 08/01/2014
Oberseminar: Biological Models and Statistical Mechanics	<b>Berlin</b> 22/10/2012
Mark Kac Seminar	<b>Utrecht</b> 05/10/2012

### Contributing talks

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Cluster expansions: from combinatorics to analysis via probability	<b>Oberwolfach</b> 08/02/2017
12th German Probability and Statistics Days 2016	<b>Bochum</b> 02/03/2016
Spatial Models in Statistical Mechanics	<b>Darmstadt</b> 24/02/2014

40th Probability Summer School

**Saint Flour**

06/07/2010

PIMS-UBC Summer School in Probability

**Vancouver**

22/06/2009

## Teaching

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### **Eindhoven University of Technology**

**Eindhoven**

02/2015–04/2015

Lecturer of a Bachelor course in financial mathematics

### **Stockholms Universitet**

**Stockholm**

04/2014–01/2015

Lecturer of Bachelor and Master course in financial mathematics

- Advanced financial mathematics (Spring 2014)
- Introduction to financial mathematics (Fall 2014)

This introductory course is aimed at bachelor students in mathematics and people working in industry (mostly insurances). For this mixed audience I design a new course that is applied and gives a brought overview of financial mathematics.

### **Eindhoven University of Technology**

**Eindhoven**

09/2008–2011

Instructor for seven courses on bachelor level for statistic, probability and calculus

- Statistics for architecture (Fall 2008, Fall 2008, Spring 2010)
- Statistics for innovation sciences (Spring 2011)
- Introduction to mathematics for applied physics (Fall 2011)
- Calculus for engineering (Fall 2010, Fall 2011)

## Supervision

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Since 2017 I supervise Master and Bachelor projects.

Supervisor for students in an online learning project: Technology Enhanced Learning of Mathematics for Master Education (TELMME, <http://dam02.win.tue.nl/elmi/>). The TELMME project is an online platform, where students are supposed to solve weekly exercises. My task was to supervise their learning progress and offer assistance for technical problems.

## Creation of supplementary material for the course

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Together with a colleague, Tim Hulshof, I created a 30 page summary for a bachelor course on probability and statistic for non-mathematicians in Dutch. This summary is based on the text book: Applied Statistics and Probability for Engineers (Montgomery).

R. Fitzner and T. Hulshof, Algemeen overzicht inleiding kansrekening en statistiek. (2010)

While giving a course on probability and statistics, Tim Hulshof and I realized that many of our students struggled with the notions of the course, due to their non-mathematical background. As courses at this level are given at the TU Eindhoven for at least 500 students each year we decided to create a summary of the material in Dutch. This summary is now used by the students as an addition to the text book. On my homepage you can find a link to this document.

## Languages

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**German:** Mother tongue

**English:** Fluent

**Dutch:** Good

**French:** Basic

## Computer skills

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**Languages:** Java, C++, JavaScript, Perl

**Work related:** Linux (Red hat, Ubuntu, slashware) and Solaris

**Simulator:** I created an applet that generates images and real-time animations for several stochastic models that is intended to be used within teaching/research. The model creates simulations of random walks, percolation, bootstrap percolation and the sandpile model. The program has already been used by me and others to introduce the percolation model and its phase transition in talks and courses on percolation. The program can be found on [www.fitzner.nl/simulator/](http://www.fitzner.nl/simulator/).

**Numerical studies:** In two projects, one with Mia Deijfen and another one with Tim Hulshof, I have studied the behavior of large networks using a simulation study. The code of these projects is available on my webpage.

**Visualisations:** To visualise the topic presented on the networkpages.nl I have create a number of interactive animation(JavaScript). A complete list can be found at [www.networkpages.nl/CustomMedia/](http://www.networkpages.nl/CustomMedia/)

**Computed assisted proofs:** For results obtained in the NoBLE project certain numerical condition need to be satisfied. These condition have been verified using Mathematica notebooks. An overview of this project and these files can be found at [www.fitzner.nl/noble/index.html](http://www.fitzner.nl/noble/index.html)