

# PACE Paderborn Institute for Advanced Studies in Computer Science and Engineering



# EDITORIAL



International Graduate School  
**Dynamic Intelligent Systems**

**International Research Training Group**  
*„Geometry and Analysis of Symmetries“*

International Research Training Group  
**Geometry and Analysis of Symmetries**



Research Training Group  
**Scientific Computation: Application-oriented Modelling and Development of Algorithms**



Center for Optoelectronics and Photonics Paderborn  
**Micro- and Nanostructures in Optoelectronics and Photonics**

## Welcome

Allow us to introduce you to PACE, the University of Paderborn institute that organizes our three-year PhD programs in mathematics, mechanical and electrical engineering, informatics, and the natural sciences. Paderborn University was one of the first institutions in Germany to offer international students fully funded PhD programs in English, and to combine these with organized cultural events and soft skill training. Since the year 2001, our expertise has grown in guiding doctoral researchers towards their degrees within an average of 38 months. We are very proud of our more than 50 alumni from all over the globe.

The following pages should give you a good impression of who we are and why Paderborn would be an excellent place for you to complete your PhD. We are looking for the most talented students to join us in furthering our innovative scientific research. Feel free to contact us with your questions, and be sure to explore the further information on our website at [www.uni-paderborn.de/pace](http://www.uni-paderborn.de/pace).

We hope to meet you in Paderborn soon!

Prof. Dr. Wilhelm Schäfer (Chair)



Prof. Dr. Eckhard Steffen (Managing Director)



# WHY PACE?



## Challenging

We challenge you to complete your PhD in 3 years. That means we look for intrinsically motivated students who will excel in our academic culture based on research freedom.



## Interdisciplinary

At PACE, mathematicians talk to mechanical engineers, and physicists collaborate with software engineers. You will also profit from an extensive academic network far beyond Paderborn University.



## Supportive

We understand doctoral students need to focus on research. That is why we do not require you to teach. We also help you structure your 3 years to ensure success. And we take care of all the time-consuming administrative details.



## Practical

We have excellent partnerships with companies such as Daimler, Lufthansa and Wincor Nixdorf. Through projects with our industry partners, your research can provide solutions to real world business problems.



## International

Our students come from all over the world. During our program they can take advantage of a full program of intercultural activities, soft skill training, company visits, and German language classes.



## Affordable

At PACE you receive financial aid in the form of a fellowship, and reimbursement of travel costs. We even reimburse the costs of your admission interview, whether you are accepted or not.

Meet our Students  
Timo Pfau, Germany



“The first things I did as a doctoral student were to get to know my supervisor and work group, as well as spend a lot of time researching the literature for my topic. In the beginning I got a lot of help from my more experienced colleagues and my supervisor determined the tasks I worked on. Later, I developed my own approach and started to guide the junior colleagues.

“After one year I published my first paper. This also helped me with preparing for my intermediate exam where I could present first results and my plan for the remaining two years of work. The exam was actually quite relaxed. You mainly need to demonstrate that you will be able to finish within the 3-year time frame.

“3 years is tight for a PhD. You don't have the luxury of taking long vacations! But the conferences I attended on 3 different continents made up a bit for the lack of holidays. I also attended various lectures and made use of the cultural program that PACE offers. There were trips to Heidelberg and Ulm for example, which were a lot of fun. From the complementary soft skill training program I attended workshops on leadership and conflict management.

“The last months of my PhD were tough, because I still had to do some experiments and in parallel to write my thesis. But in the end the effort was worth it.”

## Program Content

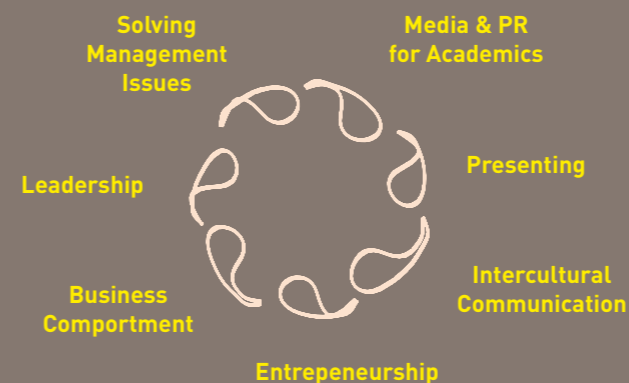
End of Year 1

End of Year 2

End of Year 3

Intermediate Exam

- Conferences
- Presentations
- Research
- Lectures
- Soft Skill Training
- Cultural Program
- Supervision



## Soft Skill Training

Gain essential leadership skills for your career  
Success in both academia and industry is dependent on more than just expertise in your chosen discipline. Nowadays all employers expect to hire professionals who are not just technical experts, but are also managers with superior communication skills, able to work across cultures. Skills such as decision making and marketing your project can be learned and trained. This is why PACE offers all doctoral students the option to participate in soft skill training workshops.

# STUDY PROGRAMS

On the following 8 pages we introduce our 4 PhD programs. Please visit the websites to learn more about the research focus, the professors, supervisors and the opportunities in these 4 study programs.

International Graduate School

## Dynamic Intelligent Systems

Find out more at  
<http://graduateschool.uni-paderborn.de>

### Subjects

Computer Science  
 Engineering  
 Business Administration  
 Mathematics

### PhD projects could be in areas like

Reconfigurable Hardware and Software Components  
 Resource and Communication Management in Dynamic Networks  
 Organization of large Dynamic Networks  
 Interdisciplinary Design Processes  
 Performance-oriented Modelling and Specification Techniques  
 Intelligent Systems in Production and Logistics  
 Intelligent Mechatronic Systems



**Meet our Students**  
**Cheng Yee Low, Malaysia**

"I'm originally from Kerayong, a small village in Malaysia. In contrast to crowded London where I did my Masters study, Paderborn sounded like a lovely historic university town. It's peaceful and the people are friendly. Deciding for the University of Paderborn was easy. When I was here for my interview, they showed me around the laboratories and departments. Looking at their work, you immediately realize they are at the forefront in their respective fields. I was really impressed. Their research closely described my interest. I'm glad to be a member of the family now.

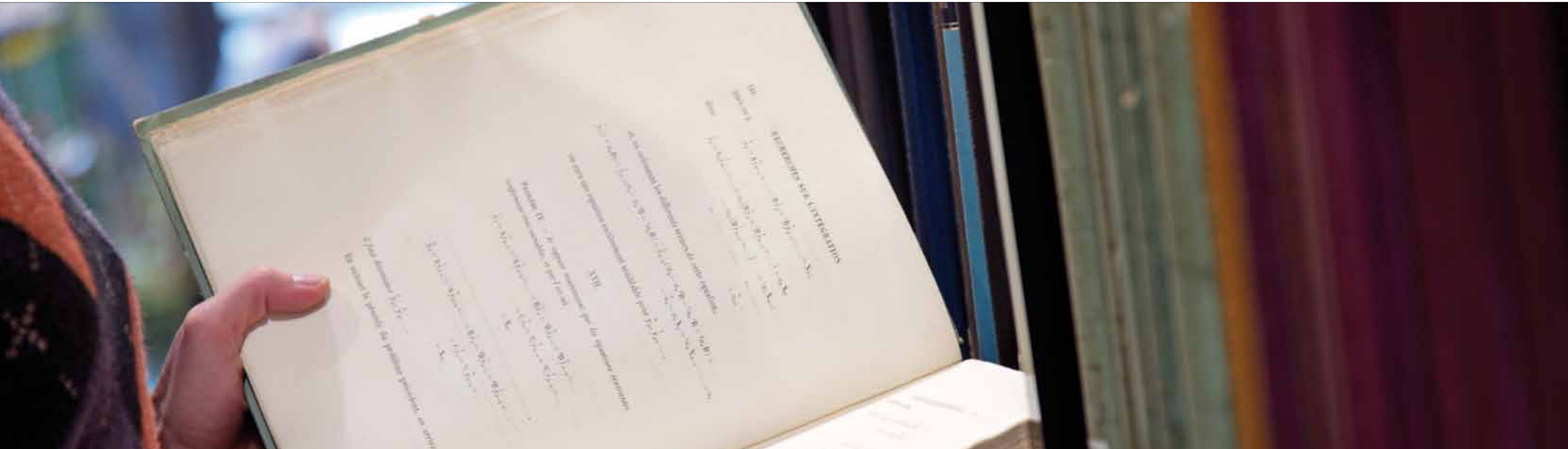
"The academic culture here emphasizes teamwork, but you are expected to have your own

contribution. You have to help your working group progress. As most of the projects here are interdisciplinary, you will also need to understand what others are doing in adjacent fields. Your supervisor knows exactly what you are working on and guides your research by patiently giving you strategic advice. Obviously, you have to figure out the details on your own, but your colleagues will be ready to support you. Although the research is theoretical, many of the projects here have very close collaboration with industry. I was involved in a large-scale research project funded by the German Research Foundation. The project consists of approximately 50 scientists. It is interesting to see how the work is coordinated and managed,

taking into account the diverse expertise and interests of the researchers.

"There have been plenty of happy moments in Paderborn. Friendships grow slower here, but they seem to last longer. There are a lot of international students at the university and in PACE. We cook together, play card games in the evening, and play badminton occasionally. In my spare time, I also enjoy cycling through the fields behind the university and around the Pader Lake. The cost of living in Paderborn is low and we receive a handsome fellowship. We manage to visit other European cities as well. Of course I get homesick sometimes. Then I call home or cook some Asian food!"

# STUDY PROGRAMS



International Research Training Group

## Geometry and Analysis of Symmetries

Find out more at  
<http://irtg.uni-paderborn.de>

Subject  
 Mathematics

PhD projects could be in areas like  
 Computational representation theory  
 Harmonic analysis on symmetric (super) spaces  
 Infinite-dimensional Lie theory  
 Non-commutative Geometry  
 Quantization schemes  
 Representation theory of algebras  
 Shimura varieties  
 Unitary and geometric representations of Lie groups



Meet our Students  
 Indraava Roy, India

“As IRTG students we spend time in both program locations: Metz and Paderborn. In this way, we can profit from two strong mathematical cultures, French and German, with traditions going back to the Renaissance period. The quality of the research here can be seen in the published papers and the fact that our professors are well-known in their respective fields. Paderborn has an excellent library as well. We also get direct exposure to the greatest minds in mathematics today. We can attend conferences and all travel is reimbursed. Next year I will go to Italy to study with a professor there. In India I would have to be in a specialized institute to get a similar amount of exposure to high-level maths.

“Of course it is helpful to learn German and French. I see that as an opportunity to broaden my cultural knowledge as well as my network in mathematics. I will have a lot of options for post-doctoral work due to this exposure. In both Paderborn and Metz, everyone is eager to help you, both in terms of your research and for personal issues such as getting your insurance organized. The contact with colleagues is excellent; some are good friends by now. The relationship with my supervisor is extremely open. He gives me tips on how to progress with my research. From him I learn first-hand how to approach my problem to ensure I will achieve my PhD in three years.

“A PhD is not easy, no matter where you do it. They don't hand

you your degree on a plate, and you will have to work hard, and most importantly you will need to persevere. But here you get to learn directly from experts in their fields. When you start, you're not expected to be an expert. I have a very different background (in applied maths) than my current research. Nevertheless, it's challenging, so you really need to be self-motivated. It's not just about working hard, but about being willing to ask “stupid” questions and to take responsibility for your own learning. You're starting from scratch in some cases, and that is accepted and even expected. There are also Summer Schools and Workshops that are very helpful. It's a great opportunity to study here.”

International Research Training Group  
 „Geometry and Analysis of Symmetries“

Initiated and supported by the Deutsche Forschungsgemeinschaft (DFG), the French Ministry of Education, Science and Research (MENESR) and the Franco-German University (DFH-UFA). Accepted by the DAAD to be included into the new bi-national PhD-Network (PhD-Net).

# STUDY PROGRAMS



Research Training Group

## Scientific Computation: Application-oriented Modelling and Development of Algorithms

Find out more at  
<http://www.pasco.uni-paderborn.de/gk>

### Subjects

Mathematics  
 Computer Science  
 Electrical Engineering

### PhD projects could be in areas like

Algorithms and Complexity  
 Codes and Cryptography  
 Communications Engineering  
 Computational Dynamics  
 Numerical Mathematics  
 Parallel and Distributed Computer Systems



**Meet our Students**  
 Stefanie Naewe, Germany

"In PaSCo we try to build a bridge from academic scientific computation to concrete industrial applications. Modern computers are very powerful, but the computations still have to be thought through: they can be inefficient and you have to watch the numerical precision. Part of what we do concerns the analysis and classification of computational problems, and we try to design models and improve the algorithms on a theoretical level. Another part of our research concerns the scientific development of algorithms for concrete applications, such as in speech recognition software or computer graphics.

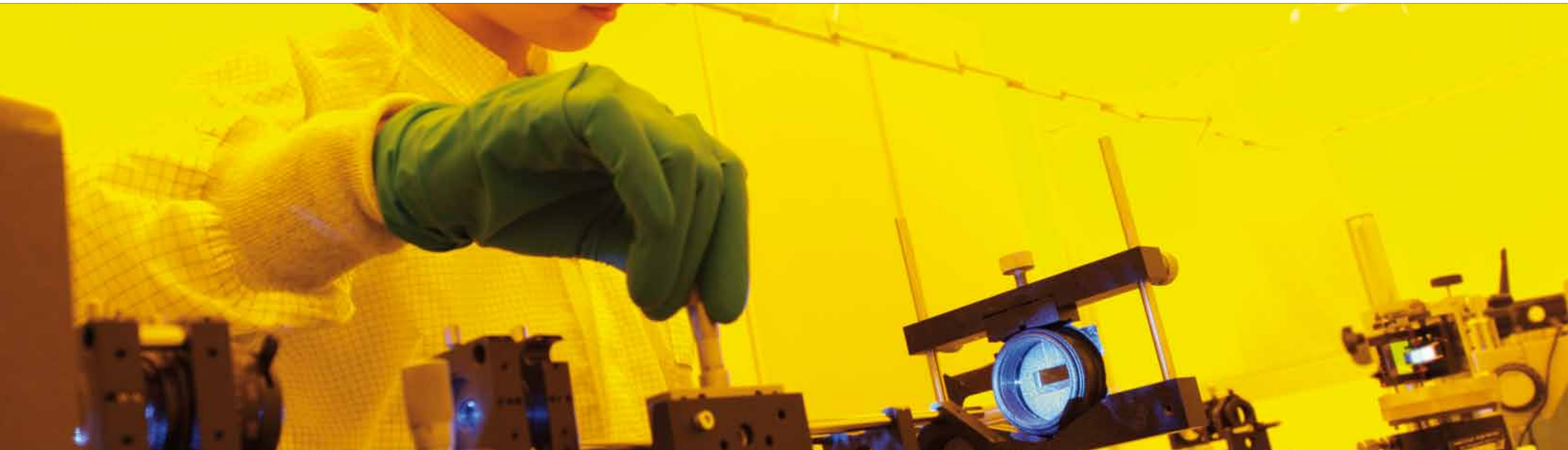
"Theoretical computer science is a part of scientific

computation and is a discipline that evolved from mathematics. I am a mathematician working in computer science and so is my supervisor. My project concerns lattices (a pure mathematical object from discrete mathematics). In the '80s lattices became popular as a research area in computer science because they can be used for the construction of 'provably secure cryptosystems'. Our goal is to get a deeper understanding in lattices particularly in the relation between different lattice problems.

"This subject area is interdisciplinary by definition. We work with mathematicians, computer scientists and electrical engineers. The

mix of experts in these three areas creates a lot of research potential. For doctoral students this means we can follow high-level lectures in all subject areas. You learn about how research is conducted and problems are approached by others in related fields. By discussing your project with colleagues from other disciplines, you gain new insights and progress within your own research. You work with your supervisor on a daily basis in a very informal way. Needless to say, it is really important to have a good working relationship with your supervisor, which is what PACE provides."

# STUDY PROGRAMS



Center for Optoelectronics and Photonics Paderborn

## Micro- and Nanostructures in Optoelectronics and Photonics

Find out more at  
<http://www.ceopp.com>

### Subjects

Physics  
 Chemistry  
 Electrical Engineering

### PhD projects could be in areas like

Photonic Crystals and Metamaterials  
 Physics and Technology of  
 Optoelectronic semiconductors  
 Microscopic Quantum Theory and  
 Electrodynamics Simulations  
 Integrated Optics  
 Sensors  
 Polymers and Colloids  
 Liquid Crystals



**Meet our Students**  
 Anna Grodecka, Poland

“My topic of research is the theory of quantum computers, one of the fastest developing fields of current research combining physics and computer science. I study tiny physical systems, the so called quantum dots able to confine single electrons that could serve for a new type of computers based on quantum processes. I develop theories concerning optical and electronic properties of such semiconductor systems, which can be used for quantum information processing and its optimization.”

“Here in Paderborn, we collaborate within various projects combining theory and experiment, which leads to fascinating and stimulating research conditions. A continuous dialog between theoretical and experimental researchers from the interdisciplinary Research Training Group allows not only for fruitful exchange of information, knowledge and experience, but also for staying up to date with the newest scientific results.”

# UNIVERSITY OF PADERBORN



“The German academic tradition is known worldwide for its high quality, partly due to the strong competition for professorships at universities. I came to Paderborn specifically because of how active the mathematical research staff is here. You can tell from the publications, the seminars and the guest lecturers that the level of mathematics in Paderborn is really high.” – Nikolay Dichev, Bulgaria.



“Not only do we receive a full fellowship, all our travel to conferences and other locations for research is reimbursed by PACE. In contrast to many other universities, we have our own desks, printer, and laptops – a real luxury for PhD students.” – Christoph Danne, Germany

The University of Paderborn is Germany's “University for the Information Society”. Mission, vision and values of the university are led by this principle. For this reason, our university focuses on computer science and its applications, primarily on the IT-related aspects of interdisciplinary collaboration in which multiple departments play a role. Paderborn University aims to become a driving force in the scientific-technological development of the information sciences, while simultaneously accompanying this development with an open and critical mind.

All university disciplines are committed to this guiding principle, with computer science naturally serving as the lead discipline, supported by mathematics in its capacity as a theoretical basis, while information technology, electrical and mechanical engineering, physics and chemistry, economics and business administration, arts and humanities all have important parts to play. Together they all contribute to developing and critically exploring the information society.

Paderborn's guiding principle certainly incorporates internationality and artistic presence, since the dimensions of the information society are absolutely global. Art in all its forms serves as a counterpoint to the sometimes studious world of a university. So the University Orchestra, the Big Band, the Jazz Choir, the Studio Stage and the regular art exhibitions are indeed important features of Paderborn's academic life.

Learn more on the university website [www.uni-paderborn.de](http://www.uni-paderborn.de)

# PADERBORN



“Paderborn is a city with a high quality of life. It is not too big, so that it is possible to relax and enjoy outdoor activities in its vicinity. Nevertheless, it has everything needed in terms of student life and entertainment. Because of lots of partnerships between the university of Paderborn and universities all over the world, it is easy to get to know international students. Moreover, Paderborn’s central location in Germany encourages visiting other places.” – Daniel Brodkorb, Germany



Our university town is located in the heart of Germany and has a rich history dating back to Stone Age settlements. Paderborn was the location for historic events such as the publication of the first book against witch hunting in 1630, and the establishment of the oldest Westphalian university in 1614. Paderborn is now a modern city with a young population. High-tech industry and medieval buildings exist here side by side. It is home to a wide range of attractions: from the world’s largest computer museum, to lively cafes and festivals, to parks and forests.

Our city hosts a variety of global businesses that are headquartered in Paderborn and surroundings. Most of these cooperate with university research projects. Paderborn excels in the computer and electronic industries, mechanical engineering, machine tool and structural steel engineering, furniture making, and food processing.

## A good base to discover Europe

with its own airport and excellent railway connections, it is easy to plan a weekend trip to Berlin, Paris or Amsterdam.

## A green, clean, and safe environment

you can travel everywhere by bike or bus and do not need to worry about walking home at night.

## Excellent sports facilities

an offer of every possible sport from archery to yoga at low student rates.

## An international atmosphere

from Asian supermarkets, to tacos, to international art and music festivals.

## A taste of German culture

for example beer gardens, churches, and Bratwurst!

# APPLICATION

## Admissions Criteria

- A Master degree (or diploma) in one of the PACE subjects (mathematics, computer science, information systems, engineering, physics, chemistry, or a related field). In rare cases we accept very talented (top of their class) students with a Bachelor degree, for a shortened Master plus PhD program. If you are interested in this option, please contact us.
- Above average grades for your Master courses.
- A TOEFL score of minimum 80, or an IELTS score of minimum 7.0.

## Application Procedure

1. Determine which of our PhD programs fits your research interests and spend some time familiarizing yourself with the faculty and the research conducted in this program.
2. Read the application procedure, the application FAQ and the application form for the PhD program of your choice.
3. Contact us if you have any remaining questions about application.
4. Determine which faculty members would be suitable supervisors for your research interest. You must name 1 - 3 potential supervisors, but you do not need to contact these people directly.
5. Gather your educational documents for the application procedure:
  - Final official certificates and transcripts of your Master and Bachelor degrees, including your thesis grade (translated into English and certified).
  - TOEFL certificate.
6. Start the procedure for obtaining any missing documents, official translation and certification of documents, or completing missing tests such as the TOEFL.
7. Fill out the application form for the PhD program of your choice, attach all necessary documentation, and send the complete package to us by post.

## Admissions Procedure

We accept applications at any time. However, the various programs have set dates (usually twice a year before the start of a new semester) on which the admissions committee reviews the applicants.

Upon receipt of your application, we send you a confirmation email, asking you to complete any missing documentation. When the admissions committee meets, your application is examined along with the other applicants for that period. The committee shortlists candidates, who are then invited by email for an admissions interview in Paderborn. After interviewing all shortlisted candidates for that application period, the committee decides which students will be admitted. The result is communicated to you by email.

## Financing your PhD

Students who are admitted to a PACE program, receive a full fellowship. The procedure for requesting a fellowship is integrated in the application form. There are no additional study fees, except for a small enrollment fee. Further details, including information on the cost of living in Paderborn, can be found on the Paderborn University website under "international students".

"Since I'm personally very interested in research, it is really enjoyable for me to do a PhD. Not only can you study the topic you find fascinating, but you also get a decent scholarship and receive a highly valued degree after concluding your studies. I chose in particular to study at the computer science department in Paderborn due to matching research interests, as well as the department's and my supervisors' excellent reputation." –

Peter Janacik, Germany



"I came to Paderborn from St. Petersburg because I wanted to study the subject of data mining, which is not that popular in Russia. Key reasons for me to choose PACE were the 3-year program, the full scholarship, and the possibility to gain international experience, learning German along the way. I know my German PhD will be highly valued everywhere in the world." –

Valentina Avrutova, Russia



# PARTNERS

“The research collaboration with the Graduate School in the area of product management enables Daimler to do three things simultaneously: apply the most recent research results to practice, react flexibly to changing research focus of a high-tech company, and recruit excellent new employees for the organization.”

**Thomas Sommer-Dittrich**  
**Manager**  
 Daimler AG  
 Group Research and Advanced Engineering, Manufacturing – Vehicle – Concepts  
 Team Produktionsmanagement

“dSPACE Engineers develop hardware and software tools that turn today’s automotive and aerospace visions into tomorrow’s reality. We sponsor students at PACE because we believe that the future of technology is shaped by the commitment and the innovative talents of coming generations of engineers.”

**Dr.-Ing. Herbert Schütte**  
 dSpace  
 Director Applications/  
 Engineering and Direct Sales.

“initplan is a global technology and market leader in the area of planning systems for public transport. The advantage of our partnership with PACE is that we can make use of their considerable expertise and cutting-edge technology for the optimization of our planning software. The Graduate School in return gains access to real data that is invaluable in the creation of accurate models for research projects. This is a win-win cooperation in which the partners are continuously striving for improvement.”

**Michael Beck**  
 Director Development  
 INITPLAN GmbH

“The opportunity for cooperation with industry was the main reason for me to do my PhD in Paderborn. When you’re working for a company, solving a concrete business problem for them, you are not just trying out an idea. Your research has to be viable. It has to lead to the solution of an actual business issue. This is what really made my research interesting.” –  
 Jens Peter Kempkes, Germany



**DAAD** Deutscher Akademischer Austausch Dienst  
 German Academic Exchange Service

**DAIMLER**

Deutsch-Französische  
 Hochschule  
 Université  
 franco-allemande

Deutsche  
 Forschungsgemeinschaft  
**DFG**

Dr. Arnold Hueck-Stiftung

**dSPACE**

Fraunhofer  
 IML  
 Institut  
 Materialfluß  
 und Logistik

**HELLA**

**initplan**

**KEIPER**

**KNORR-BREMSE**

**Lufthansa**

Ministerium für Innovation,  
 Wissenschaft, Forschung und Technologie  
 des Landes Nordrhein-Westfalen



**SIEMENS**

**TRW**

**UNITY AG**

**WINCOR  
 NIXDORF**

# ALUMNI



**Dr. Tien Pham Van**  
 Vietnam  
 Class of April 2004

**PhD Thesis**  
 Proactive Ad hoc Devices for Re-  
 laying Real-time Video Packets

Tien is currently Lecturer at the Faculty of Electronics and Telecommunications, Hanoi University of Technology.



**Dr. Biljana Milivojevic**  
 Serbia and Montenegro  
 Class of April 2002

**PhD Thesis**  
 Study of Optical Differential  
 Phase Shift Keying Transmission  
 Techniques at 40 Gbit/s  
 and beyond

Biljana is currently Development Engineer at CoreOptics GmbH.

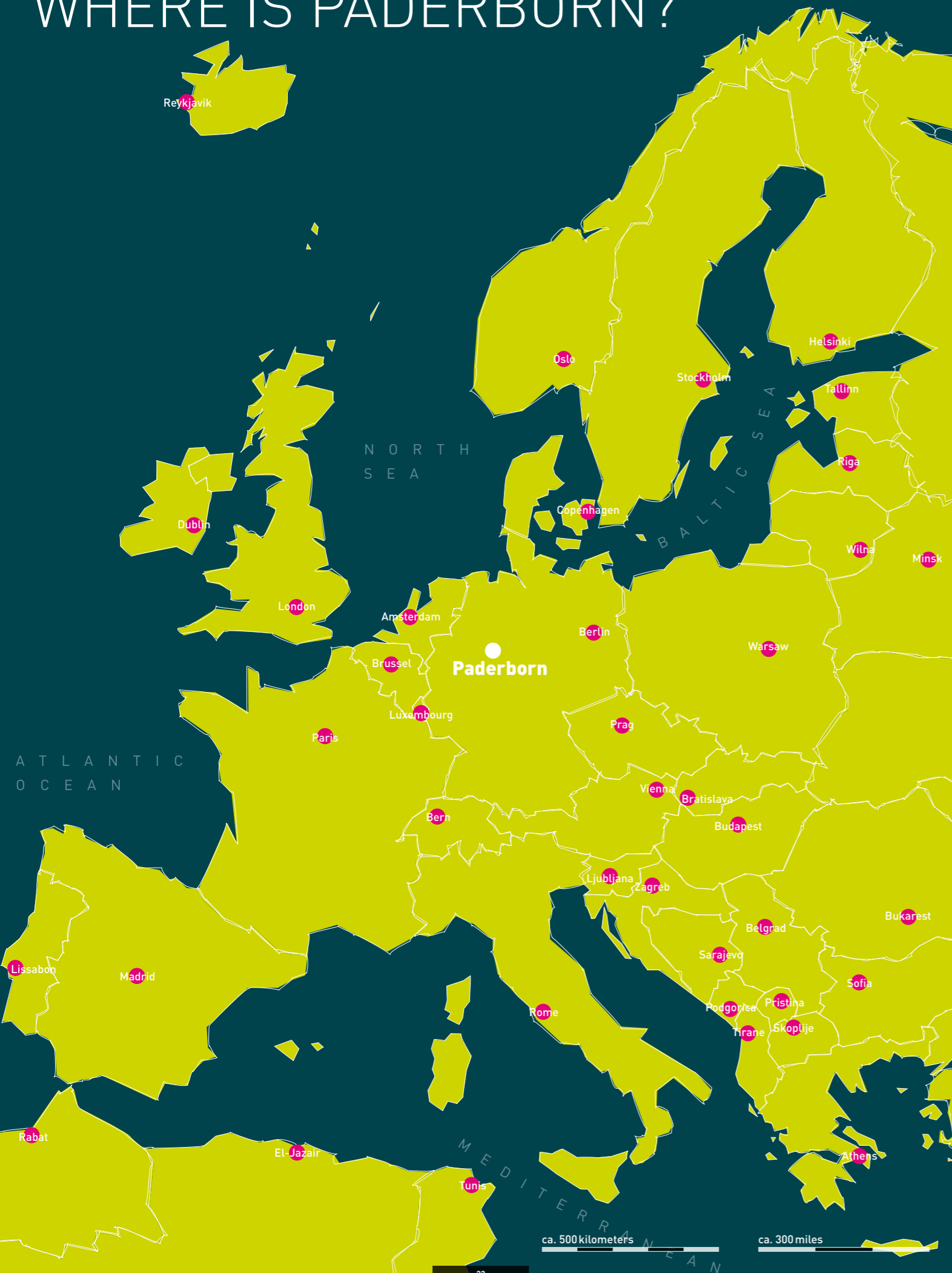


**Dr. Johannes Leßmann**  
 Germany  
 Class of October 2003

**PhD Thesis**  
 Data Management in  
 Peer-to-Peer Networks

Johannes is currently Research Scientist at NEC Europe Ltd., Network Research Laboratories.

# WHERE IS PADERBORN?



# CONTACT

## Address

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 Germany

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 E-Mail: [pace@uni-paderborn.de](mailto:pace@uni-paderborn.de)  
 Internet: [www.uni-paderborn.de/pace](http://www.uni-paderborn.de/pace)

Office hours: 09.00 - 16.00 (GMT/UTC +1)



"Excellent conditions for research and a generous fellowship. This is the good side of the coin. After starting at PACE I discovered that the other side is even better: a very helpful team and many social events to make friendships." – Semir Osmic, Bosnia

