

Country of Education		
1st Degree	Diplom	Germany
2nd Degree		None Given
3rd Degree		None Given

## **1. Personal Information**

Last Name	Nitschke
First Name	Ingo
Middle Name	
Nationality	Germany
Date of Birth	04-05-1983
Place of Birth, City	Königs Wusterhausen
Place of Birth, Country	Germany
Gender	Male
Marital Status	Not Married
Number of Children	1

## **2. Contact Information**

Street	Niederauer Platz
Street Number	04
Postal Code	01127
City	Dresden
Country	Germany
Phone Number, Home	+4917670970800
Phone Number, Work	
Fax Number	
E-Mail Address, Primary	ingo.nitschke@tu-dresden.de
E-Mail Address, Secondary	ingo.nitschke@tu-dresden.de

**3. Education****3.1. Degree Information****3.1.1 Pre Degree**

Degree Received/Expected	Vordiploma			
Subject Area of Study	Engineering mathematics			
Duration of Study	From	10/2006	To	3/2009
University/College	TU Dresden Germany			
Date Received / Expected	3/2009			
Grade (if known)	passed			

**3.1.2 First Degree**

Degree Received/Expected	Diplom			
Subject Area of Study	Engineering mathematics: Scientific Computing			
Duration of Study	From	10/2006	To	9/2014
Name of University/College	TU Dresden			
Country Acquired From	Germany			
Date Received / Expected	9/2014			
Grade (if known)				

**3.1.3 Second Degree**

Degree Received/Expected				
Subject Area of Study				
Duration of Study	From	(No Date Given)	To	(No Date Given)
Name of University/College				
Country Acquired From	None Given			
Date Received / Expected	(No Date Given)			
Grade (if known)				

**3.1.4 Third Degree**

Degree Received/Expected				
Subject Area of Study				
Duration of Study	From	(No Date Given)	To	(No Date Given)
Name of University/College				
Country Acquired From	None Given			
Date Received / Expected	(No Date Given)			
Grade (if known)				

**3.2 Course Work**

Languages (Lehrzentrum Sprachen und Kulturen (LSK) - TU-Dresden):  
English for Chemist I-II  
Polish I-IV

Chemistry & Physics:  
Anorganische Chemie (Inorganic Chemistry) I+II  
Physikalisches Grundpraktikum (Physical Basic Placement)

Mechanical engineering:  
Technische Mechanik (Applied Mechanics) I-IV  
Strömungslehre (Fluid Mechanics) I+II  
Turbulente Strömungen (Turbulent Flows)  
Energielehre I  
Numerische Methoden (Numerical Methods)

Computer Science:  
Algorithmen und Datenstrukturen (Algorithm and Data Structure)  
Programmierung (Computer Programming)

Mathematics (up to vordiploma):  
Analysis I-III  
Lineare Algebra und analytische Geometrie (Linear Algebra and Analytically Geometry) I+II  
Programmieren (Computer Programming for Mathematicians) I+II  
Numerische Mathematik (Numerical Mathematics)  
Elementare Stochastik (Elementary Stochastic)  
Fourieranalysis  
Optimierung (Operation Research)

Mathematics (after vordiploma):  
Wissenschaftliches Rechnen (Scientific Computing)  
FEM (Finite Element Method)  
Phasenfeldmodellierung (Phase Field Modelling)  
Algebraische Strukturen (Algebraic Structures)  
Universelle Algebra (Universal Algebra)  
Numerik Gewöhnlicher Differentialgleichungen (Numeric for Ordinary Differential Equations)  
Numerik Partieller Differentialgleichungen (Numeric for Partial Differential Equations)  
Lineare Modelle (General Linear Models)

**3.3 Computational, Experimental & Technical Expertise**

Practical Skill:	Computer Programming
Level of Expertise:	Advanced
Description:	
<p>Languages:</p> <p>C/C++ (incl. lot of experience in Finite-Element-Toolbox AMDiS)</p> <p>Java (incl. some software components / libraries like JavaBeans or ApacheMath)</p> <p>Python</p> <p>Fortran</p> <p>Matlab/Octave</p> <p>Programming paradigm:</p> <p>Object-oriented</p> <p>Procedural</p> <p>Functional</p>	

Practical Skill:	Modelling and Simulations
Level of Expertise:	Advanced
Description:	
<p>Cell / tissue development on (curved) surfaces (force based approach)</p> <p>Fluid dynamics (even on curved surfaces)</p> <p>Phase field approaches for interface problems or multi-component systems</p>	

Practical Skill:	Data Analysis and Data Mining
Level of Expertise:	Advanced
Description:	
Sensitivity analysis	

Practical Skill:	Computational Tools - Development
Level of Expertise:	Advanced
Description:	
<p>Finite Element / Difference Solver for partial differential equations</p> <p>Solver for equations on differential forms (Discrete Exterior Calculus)</p> <p>Mesh development</p>	

Practical Skill:	Other computational skill
Level of Expertise:	Advanced
Description:	
<p>ParaView</p> <p>Mathematica</p> <p>LaTeX</p>	

Linux Cinema4D
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**3.4 Final University Examinations**

(Nothing Entered)

**3.5 Honours and Awards**

(Nothing Entered)

**3.6 Competitive Entrance Exams for Undergraduate/Graduate Studies**

(Nothing Entered)

**4 Science and Research****4.1 Scientific Curriculum Vitae**

From:	To:	Details:
7/2003	4/2004	Military Service
4/2004	10/2004	Electrician (unskilled worker)
10/2004	4/2005	Study of Chemistry
4/2005	10/2005	Parental Leave
10/2005	10/2006	Study of Teaching Profession at Secondary Schools (Gymnasium) for Chemistry and Mathematics
10/2006	10/2007	Study Of Mathematics
10/2007	4/2008	Parental Leave
4/2008	10/2014	Study Of Mathematics
10/2009	10/2014	Undergraduate Research Assistant (SHK) - Institute of Scientific Computing (TU-Dresden) - with some breaks
10/2012	10/2013	Undergraduate Research Assistant (SHK) - Institute of Machine Tools and Control Engineering (TU-Dresden)

## **4.2 Research Accomplishments**

Peer-reviewed abstracts and publications (full citations)

I. Nitschke, A. Voigt, J. Wensch: A finite element approach to incompressible two-phase flow on manifolds. Journal of Fluid Mechanics, 708 (2012), 418-438

Non-peer reviewed abstracts and publications (e.g. technical reports)

Attendance at conferences and workshops (full details and specification of own contribution)

Workshop on Scientific Computing (June 20-23, 2010, Děčín, Czech Republic) - my talk: The vorticity equation to handle divergence free flows on Riemannian manifolds



### **4.3 Research Experience**

Since the end of 2009, I started at the Institute of Scientific Computing (IWR, TU Dresden) to work under the direction of Prof. Axel Voigt. My task was to simulate flows on surfaces and to verify the results. It quickly became apparent that the existing Navier Stokes Equations Finite Element Code for surfaces leads to incorrect results. At that time I knew nothing about mathematics on manifolds and that in general there do not hold differential equations that are designed for a flat metric. So I started to specialize me in the differential calculus for curved spaces. This topic is highly theoretical and often impracticable for numerical computations. However, I found a formula for divergence-free flows on closed surfaces with Riemannian metric that could be discretized with the available resources. In a period of about 2 years I draw up the equations for, modified it for a FEM discretization, programmed this in C++ by taking advantage of the FEM Toolbox AMDiS. Simulation and validation of results were made in the field of super fluids (e.g. from pure geometry generated vortex traps), harmonic waves on rotating spheres and (by coupling with the Cahn-Hilliard equation) two-phase flows. The results were published in collaboration with Prof. Voigt and Prof. Wensch in Journal of Fluid Mechanics. The application behind this theoretical work is phase separation in multicomponent vesicle in which the surface viscosity of the membrane is considered.

Since the end of last year, I am working on a direct discretization of differential operators of the exterior algebra, i.e. for differential forms, at the IWR (Prof. Voigt). There is great hope that metric-independent formulations of differential equations can be solved numerical directly. First results are part of my diploma thesis. So far I have the FEM discretization in AMDiS replaced by an exterior calculus discretization for (vectorized) scalar problems on two-dimensional surfaces. Currently simple problems could be solved, such as diffusion equation or approximation of the second fundamental form of the surface and the resulting curvatures.

The goal here is to allow this for vector fields on a manifold, which will be necessary (e.g. active polar gel model on a cortex) and part of my PhD thesis to be done under the supervision of A. Voigt and S. Grill.

Since 2012 I worked for 1 year at the Institute of Machine Tools and Control Engineering under the direction of Dr. Gunnar Dietz. There I developed several custom algorithms for regression and sensitivity analyzes.

This I programmed and tested in Java and embedded it into a web-based commercial application (see <http://www.symate.de/de/detact.html>).

In a modeling seminar (1 semester), I also simulated cell structures on fruit fly wings (including cell growth, anisotropy and wing curvature) by using a continuous modeling approach based on a phase field crystal model (PFC).

#### **4.4 Research Interests**

In general, I am interested in real world problems and to bring them into a mathematical context. This includes the choice of an appropriate algebraic structure, the development of the solution algorithm and its implementation, testing, evaluating and comparing results and, if necessary, to create an end-user interface.

Because of my past research, I am very interested in fluid mechanics and problems in curved spaces. This interplay between kinetics, geometry and topology is fascinating, currently not well explore and leads to new unexpected phenomena. Especially in the context of cell biology it might be a mechanism to explain varies membrane related phenomena. To explore this from a mathematical and biological side and to combine analytical, computational and experimental techniques is my main motivation for this application.



**4.5 Scientific Motivation**

This program provides the unique opportunity to combine mathematical and experimental research on a high level to explore cell biological phenomena.

**5 Research Field Preference**

Scientific Computing  
Computational Biology  
Biophysics

**6 Research Group Preference**

Voigt, Axel  
Grill, Stephan  
Sbalzarini, Ivo

**7 Other****7.1 Outside Interests**

I spent the most of my leisure with my daughter (single parent) and my dog.  
When i have enough time, i meet with my friends, do sports, hear or make music, go to concerts or festivals.

**7.2 Learned about the program**

Friends, Colleagues, Other Students, Faculty Members

**7.3 Forward to Interested Groups Outside of the Program**

Yes

**7.4 Previously Applied to the Programm**

No

## **8 Uploads**

### **8.1 Transcripts**

I haven't such transcripts.

**8.2 Certificates**

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**8.3 Awards**