Curriculum Vitae

Prof. Dr. Winfried Kurth
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Personal data

Date of birth	21 April, 1961
Place of birth	Bremen (Germany)
Parents	Ulrich Kurth, professor at the university Helga Kurth, born Baumann, teacher
Marital status	single
Nationality	German
Confession	protestant

School education

1968 – 1972	Primary school
1972 – 1981	High school (Gymnasium), Bremen
25. 5. 1981	Matriculation (Abitur)

Civil service

3. 8. 1981 – 30. 11. 1982	Civil service in the library of the Central Hospital St.-Jürgen-Straße, Bremen

Languages German (native language), English, French, Latin

Studies / further qualification

WS 1982/83 – SS 1986	Studies of Mathematics with application focus Computer Science at the University of Technology at Clausthal (Germany)
3. 10. 1984	Diploma intermediate examination
24. 9. 1986	Diploma final examination (Degree: Dipl.-Math.; equivalent to M.Sc. degree)
29. 6. 1990	Doctoral examination (Degree: Dr. rer. nat.; eq. to Ph.D.), supervisor: Prof. Dr. H.-J. Weinert (Clausthal)
5. 1. 1999	Habilitation at the Faculty of Forest Science and Forest Ecology of the University of Göttingen, acquisition of the *venia legendi* for "Forest Biometry and Computer Science"

Academic honours

3. 12. 1985	Admission to the "Studienstiftung des deutschen Volkes"
10. 7. 1986	Price of the Ministry for Science and Art of Lower Saxony for excellent student's achievements
1. 1. 2000	Heisenberg scholarship of the German Science Foundation

Professional career

1984 – 1985	Scientific tutor at the Institute for Mathematics, University of Technology at Clausthal
1. 10. 1986 – 30. 9. 1990	Junior scientist at the Institute for Mathematics, University of Technology at Clausthal
1. 10. 1990 – 31. 8. 1991	Junior scientist at the Department of Forest Biometry and Computer Science, University of Göttingen
1. 9. 1991 – 31. 8. 1993	Scholar in the postdoc programme of the German Science Foundation at the Department of Forest Biometry and Computer Science, University of Göttingen
1. 4. 1992 – 31. 5. 1992	Research stay at the Laboratoire de Modélisation, CIRAD (Montpellier, France)
1. 9. 1993 – 30. 9. 1997	Junior scientist at the Institute of Forest Biometry and Computer Science, University of Göttingen
1995 – 2001	various teaching contracts at the University of Göttingen
1. 1. 1998 – 31. 12. 1998	Junior scientist at the Bayreuth Institute for Terrestrial Ecosystem Research (BITÖK) of the University of Bayreuth in the field of Ecological Informatics
1. 4. 1999 – 31. 12. 1999 1. 1. 2000 – 30. 9. 2001	Junior scientist, Heisenberg scholar of the DFG at the Institute of Forest Biometry and Computer Science, University of Göttingen
since 1. 10. 2001	C3 Chair for Practical Computer Science / Graphics Systems at the Brandenburg University of Technology at Cottbus
since 1. 4. 2006	additionally Speaker of the Institute for Computer Science, Information and Media Technology at the BTU Cottbus; representation of the Institute in the Faculties' Council for Computer Science

Scientific experience

Since schooltime I was conducting independent research in the fields of **combinatorics**, **graph theory** and **algebra**. The practical course in software development at the University of Technology at Clausthal (in the curriculum of my studies there) implied the development of an **interactive graphics system** for hyperbolic geometry. Here, some of my own results about generating systems of Coxeter groups came to use. Investigations about the characterization and counting of regular graphs formed in 1986 the subject of my diploma thesis about "Platonic maps on the torus", supervised by Prof. Dr. W. Klotz at the University of Technology at Clausthal.
My doctoral dissertation in 1989/1990 treated a topic from theoretical computer science, more precisely, about **formal grammars** – "termination and confluence of semi-Thue systems with only one rule" (supervisors: Prof. Dr. H.-J. Weinert, algebra, und Prof. Dr. W. Lex, computer science). Before that, first results had been presented by me on congresses about combinatorics, algebra and semigroups.

In 1990, I followed the wish to work in a field where more interdisciplinary exchange is possible and went to Göttingen to the Department of Forest Biometry and Informatics in order to work there about L-system based **visual models of plants**. During my activities there, I developed 13 research applications. 11 of them were accepted (German research foundation (DFG), German ministry for education and research (BMBF), European Commission, German Academic Exchange Service (DAAD); see "Research Projects"). With the exception of a research stay at the **Laboratoire de Modélisation** of the CIRAD (Montpellier, France) and a temporary job at the Bayreuth Institute for Terrestrial Ecosystem Research (BITÖK) I stayed in Göttingen until 2001. Leading idea of my research activities there was to overcome *ad hoc* approaches in modelling plant structure and function in favour of a generic **model specification language** which is tailored to the specifities of plant morphology, physiology and ecosystem research and which enables scientists from applied disciplines an **easier access to modelling**. Furthermore, reproducibility, compatibility and validation of results of complex models can be improved by using such a language. The central field of application at that time were **combined projects of forest ecosystem research** in the framework of the Göttingen "Forest Ecosystem Research Centre" (FZW), co-founded by Bernhard Ulrich, where I was responsible for the coordination of the subprojects involved in modelling. For the other projects, I delivered input, in the shape of 3D virtual tree architectures, for detailed **simulation models** of xylem sap flow, light interception and carbon assimilation. For this purpose, I developed the rule-based language of "stochastic, sensitive growth grammars", forming an extension of L-systems, which had been introduced by Aristid Lindenmayer in 1968 and were well-known in theoretical computer science. For the creation of virtual plants on the basis of these model specifications, I developed the software GROGRA (Growth Grammar Interpreter) as a scientific tool and presented it in 1996 on the **CeBIT** in Hanover. The **graphical representation** of the generated structures was an important subitem, because thus a direct visual comparison with real plants became possible. Furthermore, the rendering of structural models with methods from computer graphics, particularly when going from the individual plant to the **level of stands or landscapes**, enables a new access to results of ecosystem research which is open also for interested laity and offers potentially decision aids for forest management authorities and landscape planners. In the context of my activities at the Forest Biometry and Informatics department, I organized five workshops, partially with international participants, where new approaches of ecological informatics, plant modelling, model specification and visualization were in the focus. A Germany-wide series of workshops of ecosystem research centres about "individual-based models and structural models" was co-founded.

My habilitation took place in 1999 at the Faculty of Forest Science and Forest Ecology of the University of Göttingen. The title of my habilation thesis was "The simulation of tree architecture with growth grammars", that of the habilitation colloquium was "carbon allocation and tree stem shape – basic facts, models and methods of representation". The topic of the public lecture was "Chaos theory and complexity theory: New perspectives on the phenomenon of 'randomness' ". Subsequently, I stayed for ca. two and a half further years in Göttingen, since 2000 as a Heisenberg scholar with funding from the German Research Foundation. During this time, I developed the application of growth grammars to ecological interactions (competition of plants, herbivore-plant interactions) and presented it at the IUFRO congress "Forest Biometry, Modelling and Information Science" which took place in 2001 in Greenwich.
In 2000/2001 I participated at an initiative to build a European ecoinformatics network for data acquisition, representation and modelling of plant structures, called **EuroPAIS** (European Plant Architecture Information Systems, http://pais.cirad.fr), together with scientists from Stuttgart, Montpellier, Grignon, Clermont-Ferrand, Helsinki, Turku, London and Warwick. A similar initiative potentially leading to a EU COST action is currently (2007) just planned, now also with people from Wageningen (The Netherlands), Dundee (Scotland) and Louvain (Belgium). Additionally, I am a member of the international "Permanent Board of FSPM" (**Functional-Structural Plant Modelling**) and have participated in the scientific committees of the plant modelling congresses "FSPM04" (Montpellier, 7. -11. 6. 2004) and "FSPM07" (Napier, New Zealand, 4.-9. 11. 2007).

In February 2001, I got the call to the full professorship (C3) for **Practical Computer Science / Graphics Systems** at the University of Technology at Cottbus, where I am working in the moment. I continue my involvement in interdisciplinary research in ecological informatics, plant modelling and visualization, now also with intensive contacts to agronomics and bioinformatics. In 2001 I started a 3-year subproject of the DFG-funded research group "Virtual Crops", the latter having been coordinated by a member of the agronomic faculty of the University of Halle. When this research group was no longer funded, my project got funding from the DFG as a single project for further 2 years. Its topic was the generalization of the string-based L-system formalism to parallel **graph grammars**. This enables now the representation of 3D morphologies, metabolic networks and genetic information in a coherent way, using one and the same model specification language. Thus, a **multiscaled modelling** in a unifying formal framework becomes possible. My team has demonstrated this new approach at mechanisms of hormonal regulation in barley and (in the context of a graduation project jointly supervised with Heiko Becker from the Department of Plant Breeding at the Agronomic Faculty of the University of Göttingen) at a model of carbon and nitrogen budget of the rapeseed plant. Furthermore, the language XL, which was designed for the implementation of these graph grammars, turned out to be well-suited for models from the field of "**Artificial Life**" (practical students' work: virtual ants, boids, social agents), for individual-based stand growth and competition modelling in forestry, and even for support in the design of buildings in architecture (joint seminars with the chair for "Building and Design in Ensembles" at the Brandenburg University of Technology at Cottbus). The open-source software project GroIMP (Growth-grammar related Interactive Modelling Platform) provides an environment for development in XL as well as features for interaction and rendering; beyond the originally intended applications in ecological informatics it was extended to a **generic modelling tool in computer graphics**.

In addition to the research focus in plant and stand modelling, new fields of research were addressed in Cottbus. As an application of novel techniques of **computer graphics**, scenes in GroIMP can now be rendered with a high degree of realism using **stochastic raytracing**; this

raytracer is currently further improved in students' projects by bidirectional path tracing and by transferring calculations to the GPU. An interface for VRML-based applications of **Virtual Reality**, also for e-learning purposes, was included in GroIMP.
A further field, where several successful graduation theses were supervised (partially jointly with the German Aerospace Centre (DLR) in Berlin Adlershof) is the **acquisition and analysis of 3D data** and the analysis of stereo images. Here, an experimental, turntable-based, self-calibrating data acquisition system on the basis of "active viewing" (stripe projection technique) was established, and, amongst others, a new algorithm for the reduction of the number of points in 3D point clouds was developed. As an application of techniques for pattern recognition, students' projects in web content analysis (texts and pictures in online newspapers and blogs) were initiated and supervised, jointly with the Chair for Internet Technology.

To present the diversity of the research topics addressed during the last years, 6 doctoral projects, supervised by me partially as main supervisor, partially as co-supervisor, will at last be sketched in keywords.

1. Visualization of predicted landscapes unter diverse scenarios of forest development (doctoral project Knauft) – a Geographic Information System with forest inventory data, a software for generating stand structures and for forest growth simulation (from the team of H. Pretzsch, Munich), and two tools for structural modelling (AMAP from CIRAD, Montpellier, and GROGRA) were coupled to produce well-founded photorealistic images and animations of future developments of forest ecosystems based on different forest management strategies. – A similar purpose is followed by a recently started cooperation project with a software company from Cottbus and with the Branitz Park Foundation which aims at a visualization of historical and future states of a park landscape near Cottbus.

2. Implementation of a mediating software for the exchange of structural information and process information between different plant models (doctoral project Anzola-Jürgenson) – in close cooperation with the CIRAD (including stay of the doctoral student in Montpellier) the focus was on the connection of models for light interception, photosynthesis, water flow and 3D structure in order to be able to model physiological and growth-determining processes in the single plant in an integrated way. The difficulties encountered in connecting diverse, existing software platforms led later to the concept of an extension of the L-system language which is specifically tailored to the problem in order to implement complex compound models in this language in a unifying and transparent way.

3. Upscaling of the results of a detailed functional-structural model (LIGNUM from the National Finnish Forest Research Centre METLA) into an extended L-system and comparison with data from an existing pine stand (doctoral project Dzierzon) – here, still on the basis of GROGRA, the step from single tree modelling to stand modelling was done, in close cooperation with METLA's forest scientists and computer scientists (including stay of the doctoral student at Vantaa) and with another doctoral student from Nancy.

4. Biostatistical analysis of the 3D branching structure of root systems (doctoral project Oppelt) – in cooperation with Douglas Godbold's team (Bangor, Wales), the analysis features of GROGRA were extended to get access to topological characteristics of coarse and fine root systems of different tree species and to conduct statistical

analyses concerning species-specific differences and ecophysiological interpretations (exploration vs. exploitation). Determination of fractal dimensions and statistical separation of special branching patterns were particular aspects hereof.

5. Creation of a multiuser Virtual Reality environment for the training of thinning operations in forestry, with connection to a visualizable, ecophysiological stand growth model (doctoral project Lanwert) – here, an individual-tree-based stand growth model, going back to previous work by Sloboda and Pfreundt, was realized already in the new language XL and using GroIMP, while the VR system, designed for e-learning purposes, uses separately developed client and server software tools (with http interface to GroIMP) – this doctoral project is just finished, publications are in preparation.

6. Theoretical foundation of Relational Growth Grammars as a parallel variant of graph grammars, precise specification of the language XL, and description of the software tool GroIMP as a platform for models in computer graphics as well as in ecological informatics (doctoral project Kniemeyer, to be finished soon).

Future research projects will aim at addressing even further fields of application in biological and ecosystem modelling and at improvement and generalization of the corresponding tools in computer science. For example, for agronomic and forestry systems a precise **light model** is essential; currently, in GroIMP a radiation model based on the raytracing principle is already implemented, which will soon undergo further improvement in cooperation with the University of Wageningen. A just started doctoral project will address the inclusion of dynamics described by continuous variables and **differential equations** into the grammar formalism, which is until now of a discrete nature, and on this basis furthermore the growth of 3D cell aggregations will be represented in the model specification language. Thus the field of **multi-scaled models for systems biology** will be opened up further.
Another promising extension of this language concerns the potential of self-referentiality (rule systems modifying rule systems). With this feature, **evolutive processes** can be modelled. This is the subject of a further, just started doctoral project under my supervision.
The field of intersection between Theoretical Computer Science (formal languages), biological/ecosystemic modelling and visualization remains exciting for me, is attractive also for the students (which is documented by a large number of students who ask for themes for graduation theses from this area) and gives potential for numerous further interdisciplinary cooperation projects.

Research projects and acquired external funding

1991	The project proposal "Formal description and computer simulation of branching habit and growth of selected tree species, using L-systems and fractals" in the framework of the **DFG postdoc programme** is accepted (runtime of **2 years**).
April/May 1992	Research stay at the *Laboratoire de Modélisation* of the CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement), Montpellier, France. Subsequently, negotiation and establishment of an official **scientific cooperation agreement** between the University of Göttingen and CIRAD, periodic visits.
1993	The project proposal "Morphological model of tree growth" (jointly submitted with Prof. Dr. B. Sloboda) in the framework of the compound project "Change dynamics of forest ecosystems" is accepted by the **German Ministry for Research and Technology** (BMFT) (runtime of **5 years**, 1 BAT IIa position and paid students).
1993–1998	responsible for the **coordination** of the 12 projects involved in modelling at the Forest Ecosystem Research Centre of the University of Göttingen.
1994–1997	Co-supervision of a doctoral student at the *University College of North Wales* in Bangor, Great Britain (main supervisor: A. D. Bell, botanist), subject: Visual models of trees.
1994	The project proposal "Water use of forest trees: Implementation of a drought-stress reaction predictor for tree and stand growth" (for one doctoral student) is accepted by the **European Commission** (runtime of 2 years).
1998	The project proposal "Connection of structural models and process-based models of tree growth" (jointly submitted with Prof. Dr. B. Sloboda; funding for a junior scientist for **2 years**) is accepted by the **German Research Foundation** (DFG).
1998	The project proposal "Numerical simulation of the hydraulic system tree-soil" (jointly submitted with Prof. Sloboda, Göttingen, and Prof. C. Leuschner, Kassel; funding for a postdoc for **3 years**) is accepted by the **DFG**.
1999	The proposal for a **scholarship abroad** (in Finland) for a doctoral student, subject: "Comparison of the tree growth simulation models Lignum and Grogra-S at boreal pine stands" (designed together with METLA, Helsinki) is accepted by the **German Academic Exchange Service** (DAAD).
1999	The proposal for a Heisenberg scholarship of the DFG (for myself) is accepted. Underlying project proposal: "Spatially-explicit models of woody plants on a physiological basis".

1999	The project proposal "Development of statistical and geometrical methods for characterizing plant and stand architectures and for model comparisons" (funding for a junior scientist for **2 years**) is accepted by the **DFG**.
2000	The project proposal "Connection of structural models and process-based models of tree growth" (jointly submitted with Prof. Dr. B. Sloboda; proposal for a continuation of the project by **1 year**, 1 junior scientist) is accepted by the **DFG**.
2001	The project proposal "Development of statistical and geometrical methods..." (proposal for a continuation by **9 months**, 1 junior scientist) is accepted by the **DFG**.
2001	The project proposal "Tools of computer science for functional-structural models of plants: Sensitive growth grammars, pattern recognition, formal representation of gene regulation networks" in the framework of the research group "Virtual Crops" is accepted by the **DFG** (funding for 2 full junior scientists' positions for **3 years**). Subsequently negotiation of a cooperation agreement with the Leibniz Institute for Plant Genetics and Crop Plant Research, Gatersleben, to establish there a guest status of a postdoc in this project.
2002	Start of a cooperation with the Department for Signal Processing of the Institute for Space Sensors and Planet Exploration of the German Aerospace Centre (DLR), Berlin Adlershof, about acquisition and evaluation of 3D data for virtual scene reconstruction and pattern recognition in point clouds.
2003	Participation with an external doctoral student (in Göttingen) at the project ELAN (**E-learning Academic Network** Lower Saxony) in the field of teaching at the Faculty of Forest Science and Forest Ecology at the University of Göttingen (with Prof. B. Sloboda; 3 years).
2005	The project proposal "Relational growth grammars as a basis for a multi-scaled metabolic structural model of barley: New techniques from computer science for functional-structural plant models (FSPM)" is accepted by the **DFG** (funding for 2 full junior scientists' positions for **2 years**).
2007	4 month research stay of a bioinformatics doctoral student from Rothamsted (UK) on the basis of a personal, EU-funded scholarship at my chair.

Ranking in previous appointment process

1996	University of Technology at Dresden, professorship (C3) for "Biometry and Computer Science in Forestry", rank 3 obtained

Cooperation projects with industrial partners and other partners outside of the university

project	*partner*	*duration*
Development of methods for feature extraction and combination of colour and 3D information from laser scanner data and digital images	German Aerospace Centre (DLR) - Unit Optical Information Systems, Berlin Adlershof	Oct. 2002 - Feb. 2003
Methods of image processing for error recognition in printed images during the printing process with special emphasis on error classification	LPCon GmbH, Berlin	Dec. 2003 - March 2005
Image - roadmask - translator: Software for automatical adaptation of a road mask to an aerial photograph	German Aerospace Centre (DLR) - Unit Optical Information Systems, Berlin Adlershof	Sept.-Dec. 2004
Visualization of protein-protein interaction networks	Leibniz Institute for Plant Genetics and Crop Plant Research, Gatersleben	May 2005 - March 2006
Interactive gene map of barley	Leibniz Institute for Plant Genetics and Crop Plant Research, Gatersleben	Jan. - July 2006
Establishment of an information system and knowledge representation system for linking historical documents, images, webpages and VRML worlds, taking a time axis into account	Stahr software development, Cottbus	since June 2006
Acceleration of matching methods by 3D laser data for fast and precise object reconstruction	German Aerospace Centre (DLR) - Unit Optical Information Systems, Berlin Adlershof	since Aug. 2006
Creation of a 3D model of the Branitz Park in VRML using aerial photographs and GIS technology (area-related data)	Stahr software development, Cottbus, and Branitz Park Foundation, Cottbus	since Feb. 2007

Reviewing

German Research Foundation (DFG), Biotechnology and Biological Sciences Research Council (BBSRC), INRIA, Ecological Modelling, Journal of Theoretical Biology, Mathematics and Computers in Simulation, New Phytologist, Annals of Botany, Silva Fennica, Transactions on Graphics, Water Resources Research, Functional Ecology, and others.

Memberships

Permanent Board of FSPM (Functional-Structural Plant Modelling) since 2003.
Scientific committee FSPM 04, Montpellier (France), 2004.
Scientific committee Systems Biology Workshop at the European Conference on Artificial Life ECAL 2005, Kent (UK), 2005.
Scientific committee FSPM 07, Napier (New Zealand), 2007.
Scientific Council of the Centre for Computer Science at the Martin Luther University Halle / Wittenberg (since 2002).
German Society for Computer Science (GI).

Invited talks

EU workshop "Unconventional Programming Paradigms" – Mont Saint-Michel (France), Institute for Bioinformatics and Neuroinformatics at the University of Lübeck, Institute of Computer Science at the University of Leipzig, Institute of Mathematics at the University of Technology at Clausthal, Institute of Mathematics at the University of Duisburg, Forest Ecosystem Research Centre at the University of Göttingen, Centre for Computer Science of the University of Göttingen, Institute of Botany at the University of Hohenheim (near Stuttgart), Agronomic Faculty of the Humboldt University at Berlin, and others.

Participation in academic self-administration

18. 12. 2002 – 8. 12. 2004	Member of the **Faculty Council** of Faculty 1 (Mathematics, Sciences, Informatics) of the University of Technology at Cottbus; member of the faculty commission for issues of teaching
since June 2003	substitute member of the commission for the investigation of claims of scientific misbehaviour (joint commission of the Academic Senate and the President of the University of Technology at Cottbus)
2004	Chairman of a habilitation commission in computer science
Jan. 2006 – Feb. 2007	**Chairman of the Appointment Commission** for the chair for "Theoretical Computer Science" at the University of Technology at Cottbus
Membership in 2 further appointment commissions (1 of them at BTU Cottbus, 1 external)	
since April 2006	**Speaker of the Institute of Computer Science, Information and Media Technology** at the University of Technology at Cottbus, Representation of the Institute in the German Faculty Council for Computer Science

Experience in Teaching

Winter term 1984/85 – Summer term 1985	Exercises in small groups in Linear Algebra (University of Technology (TU) at Clausthal)
Winter term 1986/87 – Summer term 1990	Exercises to the lectures: • Linear Algebra I and II • Complex Analysis • Numerical Mathematics • Mathematics for Engineering I and II (TU Clausthal)
Summer term 1989	Supervision of a practical training course in software development at the Institute of Computer Science at TU Clausthal
Summer term 1990	*Lecture* **Combinatorics** (2 h/week during the semester term) at the Institute of Mathematics at TU Clausthal
Summer term 1991	Initiation and supervision of a postgraduate seminar "Morphology and Fractal Geometry" at the Department of Forest Biometry and Computer Science of the University of Göttingen
Winter term 1991/92 – Winter term 1994/95	Exercises to the lectures: • Forest Biometry I and II • Introduction to Computer Science for Forestry Students
Summer term 1995	Graduate seminar "Morphological Models and Their Data Basis"
	Lecture Forest Biometry and Applied Computer Science I (4 h/week during semester term; contract given by University of Göttingen)
Summer term 1998 – Winter term 1998/99	Course "Programming in C and C++" for doctoral and diploma students at the Forestry Faculty
Summer term 1999	*Lecture* **Statistical Data Analysis** (4 h/week during semester term, contract given by University of Göttingen)
Winter term 1999/2000	*Lecture* Mathematics for Forest Science (4 h/week during semester term; contract given by University of Göttingen)
Summer term 2000	*Lecture* Biometric Data Analysis (2 h/week during semester term, contract given by University of Göttingen)
	Lecture and Exercises **Structural Models of Sprouting and Branching** (together with Institute of Forest Botany, 2 h/week during semester term)
Winter term 2000/01	*Lecture* Mathematics for Forest Scientists (4 h/week during semester term; contract given by University of Göttingen)
Summer term 2001	*Lecture and Exercises* **Structural and Functional Models of plants,** including **growth modelling** (together with the Institute of Forest Botany of the University of Göttingen and the Institute of Botany at the University of Hohenheim, 2 h/week during semester term)
Winter term 2001/02	*Lecture and Exercises* **Computer Graphics** (Brandenburg University of Technology (BTU) at Cottbus, 4+2 h/week during semester term)
	Seminar for doctoral students at the University of Göttingen (2 h/week during semester term)

Summer term 2002	*Lecture and Exercises* **Image Analysis and Image Understanding** (BTU Cottbus, 2+2 h/week during semester term)
	Lecture **Algorithms and Programming** (for students of engineering, BTU Cottbus, 2 h/week during semester term)
	Seminar **Ethical Aspects of Information Processing** (BTU Cottbus, 2 h/week during semester term)
	Seminar for doctoral students at the University of Göttingen (2 h/week during semester term)
Winter term 2002/03	*Lecture* Computer Graphics (BTU Cottbus, 4 h/week during semester term)
	Lecture **Artificial Life** (BTU Cottbus, 2 h/week during semester term)
	Seminar **Evaluation of 3D data** (BTU Cottbus, 2 h/week during semester term)
	Seminar for doctoral students at the University of Göttingen (2 h/week during semester term)
Summer term 2003	*Lecture* **Computational Geometry** (BTU Cottbus, 2 h/week during semester term)
	Lecture Image Analysis and Image Understanding (BTU Cottbus, 2 h/week during semester term)
	Lecture Algorithms and Programming (for students of engineering, BTU Cottbus, 2 h/week during semester term)
	Seminar **Artificial Life and Multiagent Systems** (BTU Cottbus, 2 h/week during semester term)
	Seminar for doctoral students at the University of Göttingen (2 h/week during semester term)
Winter term 2003/04	*Lecture* Computer Graphics (BTU Cottbus, 4 h/week during semester term)
	Lecture Algorithms and Programming (for students of engineering, BTU Cottbus, 2 h/week during semester term)
	Seminar Ethical Aspects of Information Processing (BTU Cottbus, 2 h/week during semester term)
Summer term 2004	*Lecture* **Foundations of Data Mining** (BTU Cottbus, 2 h/week during semester term)
	Lecture Image Analysis and Image Understanding (BTU Cottbus, 2 h/week during semester term)
	Seminar **Pattern Recognition in Images and 3D Data** (BTU Cottbus, 2 h/week during semester term)
	Practical course **Data Analysis and Visualization in Bioinformatics** (BTU Cottbus, 2 h/week during semester term)
	Seminar for doctoral students at the University of Göttingen (2 h/week during semester term)
Winter term 2004/05	*Lecture* Basic Aspects of Computer Graphics (BTU Cottbus, 2 h/week during semester term)
	Lecture Computer Graphics - Master level (BTU Cottbus, 4 h/week during semester term)
	Lecture **Computer Science for Environmental and Resource Management** (in English, BTU Cottbus, 2 h/week during semester term)

Winter term 2005/06	*Lecture* Basic Aspects of Computer Graphics (BTU Cottbus, 2 h/week during semester term)
	Lecture Artificial Life (BTU Cottbus, 2 h/week during semester term)
	Lecture **Introduction to Programming** (for students of engineering, BTU Cottbus, 2 h/week during semester term)
	Project Studies **Computer Graphics and Software Technology** (with Prof. Dr. Claus Lewerentz, Chair for Software System Technology at BTU Cottbus, 6 h/week during semester term)
	Studies for Professionals **Computer Science for Teachers,** module "Computer Graphics and Image Processing" (BTU Cottbus, ca. 1 h/week during semester term)
Summer term 2006	*Lecture* Image Analysis and Image Understanding (BTU Cottbus, 2 h/week during semester term)
	Lecture Computational Geometry (BTU Cottbus, 2 h/week during semester term)
	Seminar Ethical Aspects of Information Processing (BTU Cottbus, 2 h/week during semester term)
	Practical course Data Analysis and Visualization in Bioinformatics (BTU Cottbus, 2 h/week during semester term)
Winter term 2006/07	*Lecture* Basic Aspects of Computer Graphics (BTU Cottbus, 2 h/week during semester term)
	Lecture Foundations of Data Mining (BTU Cottbus, 2 h/week during semester term)
	Project studies Computer Graphics and Software Technology (with Prof. Dr. Claus Lewerentz, Chair for Software System Technology at BTU Cottbus, 6 h/week during semester term)
	Seminar **Pattern Recognition with Syntactic and Graph Based Methods** (BTU Cottbus, 2 h/week during semester term)
	Design seminar **Artificial Growth Processes** (with Dr. Günter Barczik, Chair "Design and Construction in the Ensemble" (Faculty of Architecture) at the BTU Cottbus, 2 h/week during semester term) for students of architecture
Summer term 2007	*Lecture* Image Analysis and Image Understanding (BTU Cottbus, 2 h/week during semester term)
	Lecture **Visualization** (BTU Cottbus, 2 h/week during semester term)
	Lecture Artificial Life (BTU Cottbus, 2 h/week during semester term)
	Practical course **Rule-based Programming in XL** (BTU Cottbus, 2 h/week during semester term)
	Design seminar Artificial Growth Processes II (with G. Barczik, Chair "Design and Construction in the Ensemble" (Faculty of Architecture) at the BTU Cottbus, 2 h/week during semester term)

In the summer term 2003 participation at the project "**Notebook University**", funded by the BMBF, with utilization of **e-learning** methods in the lecture "Image Analysis and Image Understanding", with smartboard, interactive learning platform, e-chalk (in cooperation with the Multimedia Centre of BTU Cottbus).

In the winter terms 2005/06 and 2006/07 organization of integrated **project studies**, involving two chairs of the BTU, with lectures, seminars and practical work in students' teams.

I would be ready to offer further teaching in **core computer science** (beyond computer graphics, e.g. algorithms and data structures, formal languages, efficient algorithms).

Evaluation of teaching

Average results of the evaluations of teaching done by the students of the BTU Cottbus for my courses in computer science in the summer terms of 2006 and 2007 (in the winter term no evaluation was carried out), excerpt:

Teacher "seems to be well prepared"	1,5
Teacher "expresses himself in an understandable way"	1,7
Teacher "is sufficiently accessible also outside the classroom"	1,5
"The red thread is visible"	2,0
Script (design and accessibility)	1,9
"I have learned much in the lectures"	2,1

(Scale always from 1 to 5, with 1 = "is completely correct", 5 = "is not at all correct").

Didactical studies

Courses absolved with a certificate at the Pedagogical Seminar of the University of Göttingen:

Didactics of Natural Sciences and Social Sciences: Interdisciplinarity at the Example of "Gene Technology"	Winter term 1990/91
Organisational Forms of Teaching	Winter term 1990/91
Science-oriented Teaching and Learning in Higher Education	Summer term 1991

Supervision of students' theses (first supervisor)

	finished	forthcoming
supervised postdocs	3	0
doctoral dissertations	4	5
diploma and master theses	14	6
bachelor theses	8	8
semester theses	20	2

Doctoral projects

Knauft, Falk-Juri: Development of methods for the GIS-supported visualization of forest development scenarios. (University of Göttingen, 14. 4. 2000)

Anzola-Jürgenson, Gustavo A.: Linking structural and process-oriented models of plant growth. (University of Göttingen, 19. 4. 2002)

Dzierzon, Helge: Development of methods for characterizing plant and stand architectures and for model comparisons. (University of Göttingen, 7. 11. 2003)

Lanwert, Dirk: Functional and structural plant modelling in e-learning scenarios (University of Göttingen, 8. 6. 2007)

forthcoming:

Kniemeyer, Ole: Design and implementation of a graph grammar based language for functional-structural plant modelling. (BTU Cottbus, to be finished in 2007)

Luo, Wanchun: Recognition and classification of text in graphical elements from web pages using image analysis techniques, taking context information into account.

Bucksch, Alexander: Development of an automatical system for the measurement and valuation of trees in forest stands and greenland on the basis of laser-supported and photogrammetric acquisition of 3D data *(preliminary title).*

Hemmerling, Reinhard: Extension of the rule-based language of relational growth grammars for the modelling of cell aggregations *(preliminary title).*

Dérer, Jan: A rule-based implementation of evolutionary algorithms in relational growth grammars for the specification of visualizable models of vegetation.

Second review:

Früh, Thomas: Development of a simulation model for the investigation of water flow in the branched tree architecture. (University of Göttingen, 1995, first supervisor Branislav Sloboda)

Buck-Sorlin, Gerhard: Crown architecture and modelling of oak (*Quercus robur* L., Q. petraea (Matt.) Liebl.) and sycamore (*Acer pseudoplatanus* L.). (Ph.D. Thesis, University of Wales, Bangor 1997, first supervisor Adrian D. Bell)

Myšiak, Jaroslav: Spatial decision making with the help of area-related information systems. (University of Göttingen, 2001, first supervisor B. Sloboda)

Oppelt, Armin: Root morphology of co-occurring African fruit tree species with contrasting strategies of exploration and exploitation. (University of Göttingen, 9. 5. 2003, first supervisor Douglas Godbold)

Epping, Thomas: Color Sequencing. (BTU Cottbus, 2004, first supervisor W. Hochstättler).

Publications

Biological modelling, ecological informatics and bioinformatics

Michael Henke, Ole Kniemeyer & Winfried Kurth, Realisation and extension of the Xfrog approach for plant modelling in the graph-grammar based language XL. *Computer Graphics Forum* (submitted). *(R)*

Winfried Kurth, Ole Kniemeyer & Branislav Sloboda, Forest structure, competition and plant-herbivore interaction modelled with Relational Growth Grammars. *Journal of Forest Science* (submitted). *(R)*

Winfried Kurth, Specification of morphological models with L-systems and Relational Growth Grammars. *Image – Journal of Interdisciplinary Image Science*, Vol. 5 / Special Issue (accepted). *(R)*

Günter Barczik & Winfried Kurth, From designing objects to designing processes: Algorithms as creativity enhancers. *In:* Predicting the Future. 25th eCAADe Conference Proceedings, ISBN 978-0-9541183-6-5 (Frankfurt/M., Sept. 26-29, 2007), 887–894.

Ole Kniemeyer, Günter Barczik, Reinhard Hemmerling & Winfried Kurth, Relational Growth Grammars – a parallel graph transformation approach with applications in biology and architecture. *In:* AGTIVE – Applications of Graph Transformation 2007, Kassel, Oct. 10-12, 2007 (accepted). *(R)*

Gerhard Buck-Sorlin, Reinhard Hemmerling, Ole Kniemeyer, Benno Burema & Winfried Kurth, A rule-based model of barley morphogenesis, with special respect to shading and Gibberellic acid signal transduction. *Annals of Botany* (accepted). *(R)*

Gerhard Buck-Sorlin, Reinhard Hemmerling, Ole Kniemeyer, Benno Burema & Winfried Kurth, New rule-based modelling methods for radiation and object avoidance in virtual plant canopies. *In:* Proceedings of the Second International Symposium on Plant Growth Modeling, Simulation and Visualization, Beijing, November 13-17, 2006 (in press).

Ole Kniemeyer, Gerhard Buck-Sorlin & Winfried Kurth, GroIMP as a platform for functional-structural modelling of plants. *In:* Functional-Structural Plant Modelling in Crop Production (eds.: J. Vos, L. F. M. Marcelis, P. H. B. deVisser, P. C. Struik, J. B. Evers). Proceedings of a workshop held in Wageningen (NL), 5.-8. 3. 2006. Springer, Berlin 2007, 43–52. *(R)*

Gerhard Buck-Sorlin, Ole Kniemeyer & Winfried Kurth, A grammar-based model of barley including virtual breeding, genetic control and a hormonal metabolic network. *In:* Functional-Structural Plant Modelling in Crop Production (eds.: J. Vos, L. F. M. Marcelis, P. H. B. deVisser, P. C. Struik, J. B. Evers). Proceedings of a workshop held in Wageningen (NL), 5.-8. 3. 2006. Springer, Berlin 2007, 243–252. *(R)*

Gerhard Buck-Sorlin, Ole Kniemeyer & Winfried Kurth, A model of poplar (Populus sp.) physiology and morphology based on Relational Growth Grammars. *In:* Proceedings of ECMTB05 (Dresden, 18.-22. 7. 2005), Vol. 2, Innovative Mathematical Methods (eds.: P. Jagers, O. Diekmann). Birkhäuser, Boston / Basel 2006 (in press). *(R)*

Winfried Kurth, Gerhard Buck-Sorlin & Ole Kniemeyer, Relationale Wachstumsgrammatiken: Ein Formalismus zur Spezifikation multiskalierter Struktur-Funktions-Modelle von Pflanzen. *In:* Modellierung pflanzlicher Systeme aus historischer und aktueller Sicht. Symposium zu Ehren von Prof. Dr. Dr. h.c. Eilhard Alfred Mitscherlich, Schriftenreihe des Landesamtes für Verbraucherschutz, Landwirtschaft und Flurneuordnung Brandenburg, Reihe Landwirtschaft, Band 7 (2006), S. 36–45.

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Winfried Kurth, Ole Kniemeyer & Gerhard Buck-Sorlin, Relational Growth Grammars – a graph rewriting approach to dynamical systems with a dynamical structure. *In:* J.-P. Banâtre, P. Fradet, J.-L. Giavitto, O. Michel (eds.), Unconventional Programming Paradigms. *Lecture Notes in Computer Science* 3566, Springer, Berlin 2005, 56–72. *(R)*

Gerhard H. Buck-Sorlin, Ole Kniemeyer & Winfried Kurth, Barley morphology, genetics and hormonal regulation of internode elongation modelled by a Relational Growth Grammar. *New Phytologist*, 166(3), 859–867. *(R)*

Armin L. Oppelt, Winfried Kurth, Georg Jentschke & Douglas L. Godbold, Contrasting rooting patterns of some arid-zone fruit tree species from Botswana. I. Fine root distribution. *Agroforestry Systems*, 64(1) (2005), 1–11. *(R)*

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Thomas Mangoldt, Winfried Kurth, Alexander Bucksch & Peter Wernecke, A system for recording 3D information with applications in the measurement of plant structure. *In:* Proceedings of the 4th International Workshop on Functional-Structural Plant Models (FSPM04), 7-11 June, 2004, Montpellier (France), 28.

Ole Kniemeyer, Gerhard H. Buck-Sorlin & Winfried Kurth, A graph grammar approach to Artificial Life. *Artificial Life*, 10(4) (2004), 413–431. *(R)*

Ole Kniemeyer, Gerhard H. Buck-Sorlin & Winfried Kurth, Representation of genotype and phenotype in a coherent framework based on extended L-systems. *In:* Wolfgang Banzhaf, Thomas Christaller, Peter Dittrich, Jan T. Kim, Jens Ziegler (eds.), Advances in Artificial Life. Proceedings of ECAL 2003, Dortmund 14.-17. 9. 2003, *Lecture Notes in Artificial Intelligence* 2801, Springer, Berlin 2003, 625–634. *(R)*

Helge Dzierzon, Jari Perttunen, Winfried Kurth, Risto Sievänen & Branislav Sloboda, Enhanced possibilities for analyzing tree structure as provided by an interface between different modelling systems. *Silva Fennica*, 37(1) (2003), 31–44. *(R)*

Winfried Kurth, Spezifikation der Simulation der Struktur und Dynamik von Pflanzenbeständen und Tierpopulationen mit sensitiven Wachstumsgrammatiken. *In:* Jochen Wittmann & Albrecht Gnauck (Hg.), Simulation in Umwelt- und Geowissenschaften. Workshop Cottbus, 7.-8. 3. 2002. Shaker Verlag, Aachen 2002, 37–51.

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Winfried Kurth & Branislav Sloboda, Sensitive growth grammars specifying models of forest structure, competition and plant-herbivore interaction. Proceedings of the IUFRO 4.11 Congress "Forest Biometry, Modelling and Information Science", Greenwich, UK (25.-29. 6. 2001). Online publication, http://cms1.gre.ac.uk/conferences/iufro/proceedings/kurthsloboda.pdf.

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Winfried Kurth, Towards universality of growth grammars: Models of Bell, Pagès, and Takenaka revisited. *Annals of Forest Science*, 57 (2000), 543–554. *(R)*

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Thomas Früh & Winfried Kurth, The hydraulic system of trees: Theoretical framework and numerical simulation. *Journal of Theoretical Biology*, 201 (1999), 251–270. *(R)*

Winfried Kurth & Branislav Sloboda, Tree and stand architecture and growth described by formal grammars. I. Non-sensitive trees. *Journal of Forest Science*, 45 (1999), 16–30. *(R)*

Winfried Kurth & Branislav Sloboda, Tree and stand architecture and growth described by formal grammars. II. Sensitive trees and competition. *Journal of Forest Science*, 45 (1999), 53–63. *(R)*

Winfried Kurth, Die Simulation der Baumarchitektur mit Wachstumsgrammatiken. Stochastische, sensitive L-Systeme als formale Basis für dynamische, morphologische Modelle der Verzweigungsstruktur von Gehölzen. Habilitationsschrift, University of Göttingen; Wissenschaftlicher Verlag Berlin 1999. 324p.

Winfried Kurth, Some new formalisms for modelling the interactions between plant architecture, competition and carbon allocation. *Bayreuther Forum Ökologie*, 52 (1998), 53–98.

Alois Kastner-Maresch, Winfried Kurth, Michael Sonntag, Broder Breckling (Hg.): Individual-based Structural and Functional Models in Ecology. *Bayreuther Forum Ökologie*, Vol. 52 (248 S.), Bayreuth 1998.

Winfried Kurth & Gustavo A. Anzola Jürgenson, Triebwachstum und Verzweigung junger Fichten in Abhängigkeit von den beiden Einflussgrößen "Beschattung" und "Wuchsdichte": Datenaufbereitung und -analyse mit GROGRA. *In*: Pelz, D. (ed.), Deutscher Verband Forstlicher Forschungsanstalten, Sektion Forstl. Biometrie u. Informatik, 10. Tagung Freiburg i. Br. 1997, Ljubljana, Biotechn. Fakultät, 89–108.

Winfried Kurth & Branislav Sloboda, Growth grammars simulating trees – an extension of L-systems incorporating local variables and sensitivity. *Silva Fennica*, 31 (1997), 285–295. *(R)*

Winfried Kurth & Dirk Lanwert, Vom Walde komm' ich her. Theoretische Modelle zur Simulation von Pflanzenwachstum. *iX Multiuser-Multitasking-Magazin*, 2 / 1997, 124–129.

Winfried Kurth, Computersimulation von Baumarchitektur und -wachstum. *Beiträge für Forstwirtschaft und Landschaftsökologie*, 31 (1997), 22–26.

Winfried Kurth & Michael Bredemeier, Modellkonzeption und -vernetzung am Forschungszentrum Waldökosysteme (Göttingen). *In*: Mathes, K.; Breckling, B. & Ekschmitt, K. (eds.), Systemtheorie in der Ökologie. ecomed, Landsberg 1996, 67–72.

Winfried Kurth, Elemente einer Regelsprache zur dreidimensionalen Modellierung des Triebwachstums von Laubbäumen. *In*: Hempel, G. (ed.), Deutscher Verband Forstlicher Forschungsanstalten, Sektion Forstl. Biometrie u. Informatik, 8. Tagung Tharandt / Grillenburg 1995, Ljubljana, Biotechn. Fakultät, 1996, p. 174–187.

Winfried Kurth, Stochastic sensitive growth grammars: A basis for morphological models of tree growth. *Naturalia Monspeliensia*, h.s. (1995).

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Winfried Kurth & Dirk Lanwert, Biometrische Grundlagen fuer ein dynamisches Architekturmodell der Fichte (*Picea abies* (L.) Karst.). *Allgemeine Forst- und Jagdzeitung*, 166, No. 9 / 10 (Sept. / Okt. 1995), 177–184.

Winfried Kurth & Dirk Lanwert, Über einige biometrische Erhebungen für ein dynamisches Einzelbaum-Architekturmodell der Fichte (*Picea abies* (L.) Karst.). *In*: Kotar, M., and Quednau, H.-D. (eds.), Deutscher Verband Forstlicher Forschungsanstalten, Sektion Forstl. Biometrie u. Informatik, 7. Tagung 1994, Ljubljana, Biotechn. Fakultät, 1995, p. 36–53.

Winfried Kurth, Growth Grammar Interpreter GROGRA 2.4: A software tool for the 3-dimensional interpretation of stochastic, sensitive growth grammars in the context of plant

modelling. Introduction and Reference Manual. 190 p. *Berichte des Forschungszentrums Waldökosysteme der Universität Göttingen*, Ser. B, Vol. 38 (1994).

Winfried Kurth, Morphological models of plant growth: Possibilities and ecological relevance. *Ecological Modelling*, 75 / 76 (1994), 299–308. *(R)*

Winfried Kurth, Modelling the growth of spruce trees using Lindenmayer systems. *In:* Fortschritte der Simulation in Medizin, Biologie und Ökologie (Hg.: D.P.F. Möller, O. Richter). TU Clausthal, Informatik-Bericht 92/6 (1992), 207–216.

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Pure mathematics and theoretical computer science

Winfried Kurth, One-rule semi-Thue systems with loops of length one, two or three. *Informatique Théorique et Applications*, 30 (1996), 415–429. *(R)*

Winfried Kurth, Beispiele zur Begriffsanalyse. *In:* Arbeitstagung Begriffsanalyse und Künstliche Intelligenz (Hg.: W. Lex). TU Clausthal, Informatik-Bericht 89/3 (1989), 75–87.

Winfried Kurth, Some combinatorial properties of complete semi-Thue systems. Strasbourg, Rapport I.R.M.A. (Eds.: G. Baron, P. Kirschenhofer), 358 (1988), p. 143.

Winfried Kurth, Vollständige Reduktionssysteme für Coxeter-Gruppen mit drei Erzeugenden. TU Clausthal, Informatik-Bericht 87/4 (September 1987).

Winfried Kurth, Enumeration of Platonic maps on the torus. *Discrete Mathematics*, 61 (1986), 71–83. *(R)**

* *(R)* = Publication with anonymous reviewing.