

Preconditions

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Objectives

Organization of the Organic Computing lecture

Content

- Organic Computing lecture
 - Objectives
 - Lecture content
 - Time, room
 - Exam
 - Contact
- Seminars
 - „Komplexe Systeme“
- Organic Computing lab
 - Tasks
 - Time, room
 - Bonus for exam
- Literature

□ Content

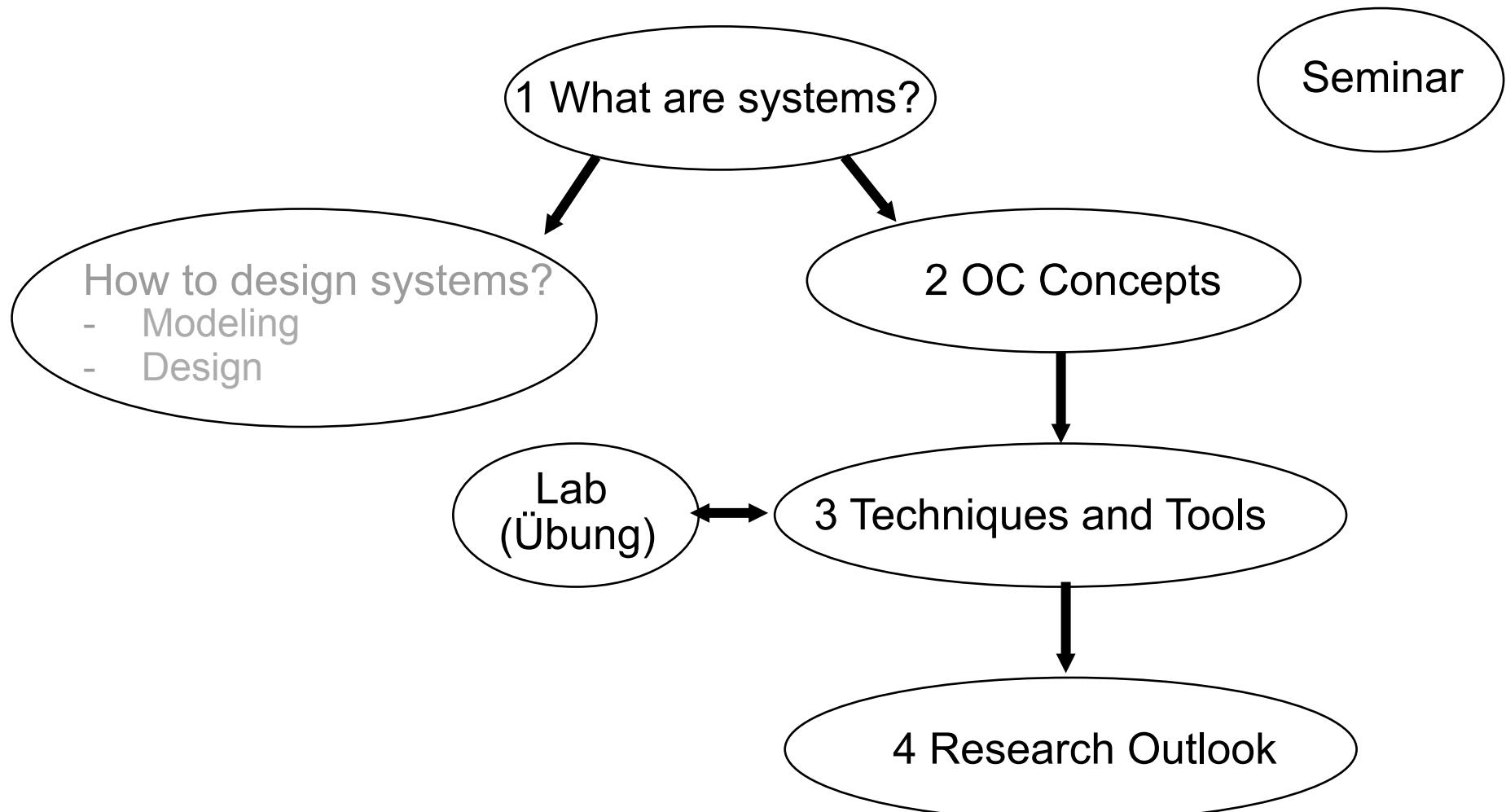
- Understanding of basic concepts of **complex systems**
- Modelling and design of **technical** systems
- **Organic** systems
- Techniques and tools used for OC

□ Target audience: Students interested in current **research**

- Especially during master catalogue

□ OC is a new research area

- Highly dynamic, rapidly changing
- You will see recent research results, schedule might be adapted ...



Part 1: Systems

Introduction
Systems
(Modelling)
(Design)

Part 2: OC Concepts

Quantitative emergence
Self-organisation & autonomy
Architectures & examples

Part 3: Techniques & Tools

Multi-Agent Systems
Ant-Colony Optimisation
Biology-Inspired Synchronisation
Ant-based Clustering
Learning Classifier Systems
Artificial Neural Networks
Artificial Hormone Systems

Part 4: Research Outlook

Three dimensions of OC

□ Lecture „Organic Computing“

- Wednesday, 16:00 - 17:30
- Winter semester
- Room 135, Appelstr. 4, 1. OG (SRA)
- Prof Dr. C. Müller-Schloer,
- Übung (Lab): Jan Kantert

□ Exam

- Oral examination
- Time schedule will be published end of December
- Bonus of up to 25% (-> lab) possible

□ Stud.IP – [please register!](#)

- Important information (e.g. changes, etc.)
- Slides, recorded lectures
- Time schedule

□ Prof. Dr. C. Müller-Schloer

- Room 105, SRA
- cms@sra.uni-hannover.de
- 0511 762-19730

□ Jan Kantert

- Room 128, SRA
- kantert@sra.uni-hannover.de
- 0511 – 762 19726

□ Monika Lorenz (secretary)

- Room 104, SRA
- lorenz@sra.uni-hannover.de
- 0511 – 762 19731

□ Seminar „Komplexe Systeme“

- Wednesday, 15:15 - 16:45
- **Summer** semester
- Room 135, Appelstr. 4, 1. OG (SRA)
- Supervisor: Jan Kantert (0511 - 762 19726)

- Topics are closely related to this lecture,
main topic changes from year to year (e.g. Cooperation and learning)
- Participation in the OC lecture is not mandatory, but it might help.
- Time schedule and topics:
=> see Stud.IP, info meeting by end of semester

- The date of the first information meeting will be announced in the Organic Computing lecture later this year!

Lab „Organic Computing“

- Friday, 10:00 – 11:30
- Room 135, Appelstr. 4, 1. OG (SRA)
- Jan Kantert

 Time schedule

- 30.10. – Introduction „Pac-Man“
- 06.11. – Tutorial „NetLogo/StarLogo“
- 20.11. – NetLogo/StarLogo
- 27.11. – Multi-Agent Systems
- Weihnachtspause
- 08.01. – Learning Classifier Systems
- 29.01. – PacMan challenge

Content

- Part 1: Programming
- Part 2: Simulation
- Part 3: Algorithms

 Part 1: Develop „intelligent“ players (ghost, Pac-Man) for „Pac-Man-Game“

- Pac-Man project in JAVA provided via Stud.IP
- Intelligent means: Better than the existing players / should be adaptive

 Part 2: Simulation tool „NetLogo“

- Tutorial
- Develop a simulation (-> work sheet)

 Part 3: Work sheets related to lecture (MAS, ACO, LCS)

Bonus for exam

- Group of 3 students
- Each of the group members will receive a **25% bonus**, if:
 - Group developed automatic Pac-Man player
 - Player has been presented by group members (last lecture)
 - NetLogo simulation has been successful
 - Group presented results of at least one work sheet during the lab
- Bonus means:
 - E.g. exam result is 4.0 → final result is $4.0 * 0.75 = 3.0$
 - Exam result is 2.3 → final result is $2.3 * 0.75 = 1.7$
 - But: 5.0 stays 5.0!

- ❑ Rolf P. Würtz (ed.): Organic Computing (Understanding Complex Systems), Springer Verlag Berlin, 2008, 356 p., hardcover [ISBN 978-3540776567](#)
- ❑ Michael Wooldridge: An Introduction to MultiAgent Systems, John Wiley & Sons, 2009, [ISBN 978-0470519462](#)
- ❑ David E. Goldberg: Genetic Algorithms in Search, Optimization and Machine Learning, Addison-Wesley, 1989
- ❑ Tom M. Mitchell: Machine Learning, The McGraw-Hill Companies, 1997
- ❑ C. Müller-Schloer, H. Schmeck, T. Ungerer: „**Organic Computing: A New Paradigm for Complex Systems**“, Birkhäuser 2011,
<http://www.springerlink.com/content/t32485387608687w/>

Systems Engineering, System Design

- ❑ Daniel D. Gajski, Frank Vahid, Sanjiv Narayan, Jie Gong: Specification and Design of Embedded Systems, PTR Prentice Hall, 1994
- ❑ B. Thomé: Systems Engineering, John Wiley & Sons, 1993
- ❑ J.-A. Müller: Systems Engineering: Prinzipien und Methoden der Systementwicklung, MANZ Fortis Verlag, 2000

□ ALife

- [Christoph Adami](#), *Introduction to Artificial Life* with CD-ROM. TELOS, The Electronic Library of Science. 1998. XVIII, 374 p., hardcover, 858gr.
ISBN 0-387-94646-2, KNO-NR: 07 34 28 52 (Springer, Berlin)
- [Steven Levy](#), *KL - Künstliches Leben aus dem Computer*, 1993,
ISBN 3-426-26477-3, Droemer Knaur

Bachelor or Master theses

- Jan Kantert: Trust-based self-organized systems with applications in
 - Grid computing
 - Sensor networks
- Sebastian Niemann: Online optimization
- Romeo Shuka: Parallel population-based optimization

=> There are always open topics – just ask ...

