Name	Titel/Abstract	Keywords	Tentative schedule
Beigl, Michael	**Sensing, Communication and Organization in Wireless Sensor Systems** This talk will present some concepts of how sensor based- and communication-systems may benefit from using organic principles and how they are able to adapt in run-time. The talk will introduce methods that blur the boundaries between communication and sensing of wireless systems, will show ways how to use self-organization to solve specific problems in communication of wireless systems and will finally present an approach how wireless systems can carry out self-structuring of data.	DFG OC, wireless sensor networks, wireless sensor systems, pervasive computing, organic computing, wireless communication, sensor systems	Tue, afternoon
Bellman, Kirstie	**Points of Entry between OC design and traditional and advanced design methodologies** This contribution presents possible points of entry between OC/self-organizational processes and advanced design methodologies. I will address a possible process to connect model-based design to manufacturing that includes new types of design generation, verification methodologies and complexity metrics with heavy use of mathematically formal semantics and other good things. The attempt is to bring together the world of advanced model-based design and its methods with those design methods possible when we add OC into the mix.	Model-based design, design verification, manufacturing, formal semantics	Mon, morning
Branke, Jürgen	**Evolutionary Algorithms to support the design of self-organising manufacturing systems** Designing complex, self-organising systems is challenging. It requires to design local, decentralised rules for the agents which result in a good global performance of the overall system. In this talk, two approaches are presented at the example of a self-organising manufacturing system where local dispatching rules are used for decentralised scheduling. The first approach supports a human designer by revealing the weaknesses of an examined manufacturing system. This is achieved by automatically searching for easy-to-analyse problem instances where the applied dispatching rule performs poorly. The other approach is to generate the dispatching rules fully automatically by simulation-based	DFG OC	Wed, morning

	Genetic Programming.		
Brinkschulte, Uwe	**Researching the Artificial Hormone System - Lessons Learned** During the 6 year timeframe of the Organic Computing Priority Program, the Artificial Hormone System (AHS) as a basis for organic task assignment in distributed embedded systems has been intensivly researched. Several aspects like real-time behavior, stability, communication overhead and assignment quality have been evaluated theoretically. The good results have been confirmed by experiments using a hormone simulator. To allow real applications, a hormone base middleware has been designed and implemented. As sample applications, the lighting system of a car and the control of an autonomous guided vehicle have been implemented and tested proofing the usability of the AHS in practice. Currently, a pure hardware based implementation is researched. Furthermore, the AHS is used as a basic mechanism to increase dependability in the frame of the new SPP 1500. There are still open questions to be researched, e.g. to improve the finding of suitable initial hormone values or to protect the AHS against malicious attacks.	DFG OC	Tue, morning
Brueckner, Sven A.	**Designing Open Swarming Systems for Dynamic Runtime Adaptation** Traditional software methodologies place the burden of achieving an optimal system response onto the designer, hoping that any scenarios presented at runtime have been accounted for in the chosen optimization solution. In a world where systems are embedded in a dynamically changing environment and where system components have to act autonomously and without complete (or even correct) knowledge of the problem state, complete design-time optimization is no longer feasible. Instead, the role of the designer shifts from developing an optimal solution to developing a self-adaptive system that is capable of dynamically finding the appropriate solution at runtime. At the seminar, we offer our experience in designing, implementing, and evaluating open self-organizing systems for real-world domains where the required capabilities (including self-adaptation for optimization) emerges from local interactions of many simple agents inspired by the architecture and processes of natural systems. In such open swarming systems, the agents are equipped to respond to changes in their environment to collectively reconfigure their activities for the emergence of optimal system-level patterns and functions. We present example designs from three application domains: dynamic prediction (the swarm induces optimal models of recently observed behavior to extrapolate them into the future), information	self-organization, emergence, swarming, evolution, feedback	Tue, morning

	management (the swarm rearranges models of document content and analyst interest to respond to new information or queries), and IED risk forecasting (the swarm dynamically accounts for new event patterns that may indicate shifts in insurgent operations). In each example, we discuss the critical design decisions that support dynamic self-organization for optimal operation at runtime.		
Brun, Yuriy	**Runtime adaptation evaluation** Self-adaptive systems often evaluate potential adaptations via static model analysis or simulation. I propose an alternative evaluation scheme: trying the adaptation out either on the live, running system or in parallel to the un-adapted system, and observing the effects. This approach likely improves precision of adaptation evaluation, allows for quick adaptation implementation, and reduces costly adaptation undos, albeit, significant technical challenges remain.	self-adaptation, adaptation selection, adaptation evaluation, runtime evaluation, speculation.	Tue, morning
Konen, Wolfgang	**Self-configuration from a Machine-Learning Perspective** The goal of machine learning is to provide solutions which are trained by data or by experience coming from the environment. Many training algorithms exist and some brilliant successes were achieved. But even in structured environments for machine learning (e.g. data mining or board games), most applications beyond the level of toy problems need careful hand-tuning or human ingenuity (i.e. detection of interesting patterns) or both. We discuss several aspects how self-configuration can help to alleviate these problems. One aspect is the self-configuration by tuning of algorithms, where recent advances have been made in the area of SPO (Sequential Parameter Optimization). Another aspect is the self-configuration by pattern detection or feature construction. Forming multiple features (e.g. random boolean functions) and using algorithms (e.g. random forests) which easily digest many features can largely increase learning speed. However, a full-edged theory of feature construction is not yet available and forms a current barrier in machine learning. We discuss several ideas for systematic inclusion of feature construction. This may lead to partly self-configuring machine learning solutions which show robustness, flexibility and fast learning in potentially changing environments.		Mon, afternoon

Laddaga, Robert	**Mission Aware Adaptive Response System** We envision technology to allow mission requirements to be expressed such that hosts, routers and media configuration can be tailored to those mission requirements in a semi-automated fashion. The mission requirements would accompany the configured system, and later be referred to as monitoring or human intervention indicated a change in requirements, or physical or cyber damage sustained by the system. Regeneration or reconfiguration of components would then be enabled using the original or modified mission requirements, and the current monitored state of the system. We call the system "a mission-aware adaptive response system" (MARS). A MARS system would significantly improve mission effectiveness and cost, and potentially save lives. Configuring to mission requirements plus whatever additional capabilities are mandated by policy will ensure that mission needs can be met, without expensive and unnecessary oversupply. More important is the effect of adaptation to mission changes or physical and cyber damage. Repair and reconfiguration could mean the difference between mission failure and success.	Self Adaptive Software, Cyber Security, Information Survivability, Biologically Inspired Systems, Adaptive Immunity	Tue, afternoon
Landauer, Chris	**Run Time System Design** In this talk, we describe an approach to building autonomous systems for hazardous environments that may be more flexible than the methods currently in use. The system gains this flexibility by doing some of its own system design in response to either environmental activity or internal failures or enhancements, at run-time. The basic idea is that it contains generic models of its own behavioral requirements, which are expected to interact with certain kinds of environmental behavior, and depend on certain capabilities of the hardware behavior. As the hardware degrades, or new software capabilities are provided, or the environmental behavior changes, the specializations used at the beginning of deployment are re-examined, and the decisions revisited. The approach depends on the Wrapping integration infrastructure for software-intensive systems, and on the expectation models for the evolution of the environment. All of the models can be changed remotely (as long as the necessary hardware is available), and the models define the behavior of the system.	Self-Modeling Systems, Model-Based Design, Model-Based Execution, Wrapping Integration Infrastructure	Tue, morning

Maehle, Erik	**The Six-Legged Walking Robot OSCAR as a Demonstrator for the Organic Robot Control Architecture ORCA** Autonomous mobile robots are complex machines being challenging to engineer and to program. In order to master this complexity, the Organic Robot Control Architecture ORCA has been developed making use of organic principles like self-organization, self-reconfiguration and self-healing. The six-legged walking robot OSCAR is introduced as a demonstrator for ORCA. Organic principles are employed on all layers of its hierarchical control system starting at the reflexive layer with gait generation and reflexes over the reactive behavioural layer up to the deliberative planning layer. Experimental evaluations demonstrate that the OSCAR thus attempts to continue its mission in the best still possible way by adapting to internal faults as well as to unforeseen environmental situations.j		Wed, morning
Müller-Schloer, Christian	**Introduction to design-time to run-time design shift challenges**	DFG OC	Mon, morning
Nelson, Phyllis	**Self-Organized Self-Improvement: Using Self-Directed Experimentation to Improve Models and Methods** An important link between a system's current situation and its top-level purposes and goals is those models and methods that the system uses to choose its behaviors. If the system lacks models and methods that match well to its current condition and context, it may no longer be able to appropriately link its resources to its purposes and goals. Biological systems use some of their spare time and energy to explore both their own capabilities and their environment. We discuss our version of this style for self-organizing behaviors that enable a system to improve its models of both its own current capabilities and its environment, as well as how the system can determine if such self-improvement is appropriate.	self-modeling systems, model-based systems, biologically-inspired systems, Wrapping ingegration infrastructure	Tue, morning
Peters, Gabriele	**A proposal how to combine bottom-up emergence and top-down control during runtime** A system is proposed which combines two levels of learning: implicit or bottom-up learning and explicit or top-down learning. Both levels negotiate during run-time and estalish a balance	reinforcement learning, believe revision, bottom-up emergence, top-down control, computer vision	Mon, afternoon

	between bottom-up emergence and top-down control. The bottom-up and top-down learning components are realized by techniques of reinforcement learning (RL) and believe revision (BR), respectively. The RL component is able to react to runtime events and learns behavioral strategies in a flexible way. However, what is learned by RL is availale in a numerical form only. Especially, it is not intuitively understandable by humans, e.g., system designers or users. In contrast, the BR component acquires (also during runtime and guided by the RL component) knowledge in the form of rules. These rules in turn control the bottom-up RL process from top-down. In addition, they are comprehensible by humans. Thus, the BR component can act as an interface for intervention from outside the system by a system designer or a user in case the system displays undesired behavior. Work in progress is briefly presented where this system design is applied to a computer vision task.		
Platzner, Marco	**Engineering Proprioception in Computing Systems** In this presentation I will give an introduction to the objectives and working areas of the recently started project “Engineering Proprioception in Computing Systems” (EPiCS). EPiCS is part of the EU FET objective Self-awareness in Autonomic Systems and relies on self-awareness and self-expression as key concepts for enabling complex future computing and communication systems.	DFG OC, self-awareness, self-expression, autonomic systems	Tue, afternoon
Rammig, Franz.	**Cyber Physical Systems (CPS) or better Cyber Biosphere (CBS)?** Future systems of information technology, including such ones embedded in any kind of technical artifacts are heading into a degree of complexity which is far beyond today`s level. As most technical artifacts will be interconnected in some sense (“Internet of Things, Cyber Physical Systems”), IT systems of the future cannot be treated as isolated entities any longer. In fact, it is estimated that in the near future more or less every technical artifact above some minimal complexity will be linked to the Internet. Two major tendencies to cope with this challenge can be observed. The first one takes its inspiration from the technical roots of Embedded Systems. They are looked at from their technical nature but the traditional boundaries of Embedded Systems, especially to consider them as isolated systems are overcome. This approach became well known under the name “Cyber Physical Systems (CPS)”. The main challenge of this approach is the necessity to bridge two more or less	DFG OC	Tue, afternoon

	incompatible worlds: this one of highly predictable embedded real-time systems and this one of the stochastically operated Internet. The second approach observes the existence of highly successful and relatively stable systems in form of our biosphere. So it seems to be wise to take inspirations from the achievements of nature. This approach is being discussed in the scientific community using terms like “Biologically Inspired Systems” or “Organic Computing”. In our contribution we will discuss these alternative attempts to build the highly complex, highly sophisticated Embedded Systems of the future. The basic challenges to be solved when designing Cyber Physical Systems will be characterized. On the other hand Inspirations from ant colonies, from the hormone system, and from the immune system will shortly be discussed using specific examples. Fundamental principles for modeling and designing highly distributed, highly self-organizing systems will be pointed out. Some comparisons of CPS and CBS will be made as well.		
Robertson, Paul	**A Decade of experience building adaptive systems** In today's world computers are constantly connected and participating in the full breadth of human existence. Our world is changing at record breaking speed and yet our software is still largely designed and implemented as it was when programs were static, disconnected, and run on demand by people. My colleagues and I have now been building self-adaptive systems for over a decade and have applied them to some of the most challenging environments including real-time vision, robotics, and more recently to cyber security -- where the world can change in real-time and the need to adapt is most crucial. A lot has been learned over that period about successful approaches, technologies, and research challenges. I think that a 25 minute talk would be best for this. I believe that it can help to set on the table a collection of important issues, approaches, and challenges that can help to establish a vocabulary for the seminar. As such, I think the earlier that this talk is scheduled in the meeting the more useful it can be.	Self Adaptive Software, Biologically Inspired Systems, Adaptive Immunity, Automated Design, Model-based systems	Mon, morning
Schmeck, Hartmut	**Introduction and overview to DFG Organic Computing program**	DFG OC	Mon, morning

Schmeck, Hartmut	**Challenges for energy systems**	DFG OC	Tue, afternoon
Scholtes, Ingo	**Physics-inspired Self-Organization and Adaptation in Large Dynamic Overlay Networks** Overlay networks are becoming an increasingly important abstraction that facilitates the cost-efficient and scalable provision of novel services in the Internet. However, efficiently constructing, maintaining and managing robust and adaptive overlay topologies in the face of highly dynamic participants is a challenging task. In this talk, a physics-inspired approach towards the management of self-organizing and self-adaptive overlays will be discussed. It is based on the idea that global-scale network infrastructures like the Internet or our biggest Peer-to-Peer systems are becoming so large that it appears justified to design them along models and abstractions originally developed for the study of many-particle systems in statistical physics. The management schemes that will be presented take advantage of recently uncovered analogies between random graph theory and statistical mechanics. They constitute the basis for what may be called a *thermodynamic management* of large dynamic overlay networks.		Thu, morning
Sick, Bernhard	**Quantitative Emergence – An Overview of Recent Measurement Techniques** A technical system exhibits emergence when it has certain properties or qualities that can be termed to be irreducible in the sense that they are not traceable down to the constituent parts of the system. The presentation summarizes three techniques for emergence detection and emergence measurement that were proposed by members of the organic computing community. These techniques are based on information-theoretic and probabilistic viewpoints: the discrete entropy difference, the Hellinger distance which is a divergence measure for probability densities, and an iterative approach motivated by divergence measures. Advantages and drawbacks of these measures are demonstrated by means of some simulation experiments using artificial data sets. It is shown that these techniques are able to deal with different kinds of emergent phenomena such as transitions from chaos to order, concept drift, or novelty. That is, with these techniques it is possible to cover a wide range of possible applications.	DFG OC, emergence, self-organization, run-time measurement	Wed, morning

Teich, Jürgen	**Organic Self-organizing Bus-Based Communication Systems (OrganicBus)** In this talk on "Organic Self-organizing Bus-based Communication Systems", an organic approach for the analysis, design and optimization of arbitration and message scheduling for bus-based communication systems is introduced. The goal of this approach is to overcome drawbacks of today's pure offline designs that are based on worst-case estimations, are not expandable, and may easily degenerate when the environment or requirements change at run-time. In contrast, a decentralized approach using online self-organization is able to monitor the actual traffic of the communication system and adapt either sending rates, probabilities or offsets to establish fair bandwidth sharing and reduced response times.	DFG OC	Wed, morning
Vassev, Emil	**Knowledge Representation for Autonomous Systems – The ASCENS Case Study** Ideally, autonomous systems are intelligent systems employing knowledge to become aware of situations recognize changes and eventually respond to changing conditions. Knowledge is the key to such autonomous behavior. The fundamental questions are how to represent knowledge in such systems and how to make them use and manage that knowledge. Current and ongoing research at Lero - the Irish Software Engineering Research Centre, is focused on the problem of knowledge representation for autonomous systems formed as ensembles of special autonomous service components. Such components encapsulate rules, constraints and mechanisms for self-adaptation and acquire and process knowledge about themselves, other service components and their environment. One of the expected major scientific contributions of this research is a formal approach to knowledge representation and reasoning mechanisms that help autonomous components acquire and structure comprehensive knowledge in such a way that it can be effectively and efficiently processed, so the system becomes aware of itself and its environment.	knowledge representation; awareness; autonomous systems.	Tue, afternoon
Wiskott, Laurenz	**Slow Feature Analysis: Learning with the Slowness Principle** Slow feature analysis (SFA) is a biologically motivated algorithm for extracting slowly varying features from a quickly varying signal and has proven to be a powerfull general-purpose prepocessing method for spatio-temporal data. We have applied SFA to the learning of complex cell receptive fields, visual invariances for whole objects, and place cells in the hippocampus. On the technical side SFA can be used to extract slowly varying driving forces of dynamical systems and to perform nonlinear blind source separation. Here I will introduce	computational neuroscience, slowness learning, visual processing, dynamical systems, blind source separation	Mon, afternoon

	the SFA algorithm and give an overview over these different applications.		
Würtz, Rolf P.	**Learning to see and understand** Sensor interpretation is one of the central requirements for computing systems to interact sensibly with their environment. Moreover, the translation of sensor data into semantically meaningful representations is necessary to exploit the types of computation, in which machines are much better than humans. The most important among the sensory modalities is visual processing. In this talk I will review self-organizing methods we have developed for the recognition of human faces, human bodies, and general objects, their performance and shortcomings. Beyond organic learning of new object classes, representation of all possible visual experiences is somehow required. Human vision seems to be mainly driven by the vast amount of memorized visual experiences. I will describe some new attempts to efficiently store and retrieve these experiences, which are currently work in progress.	DFG OC, Vision, autonomous learning, sensor interpretation, user interaction, learning from examples	Wed, morning
Zeppenfeld, Johannes, Herkersdorf, Andreas	**Self-adaptive workload management on MPSoC** The Autonomic System on Chip (ASoC) architecture enables MPSoC (Multiprocessor SoC) solutions to self-organize and self-optimize key operating parameters, such as frequency, supply voltage and task allocation, during run-time. ASoC uses Learning Classifier Tables, a simplified XCS-based reinforcement learning technique which has been optimized for a low-overhead hardware implementation to achieve nearly optimal results for task-level dynamic workload balancing..	DFG OC, Multiprocessor system on chip (MPSoC), reinforcement learning, dynamic workload balancing	Wed, morning
Zhu, Junmei	**A glimpse of signaling pathways in the synapse** Learning is a key to run-time design. One of the most studied learning elements is the synapse. Computationally, Hebbian plasticity can be conveniently described by one equation. In biology, however, thousands of genes have been identified in a typical synapse. The underlying molecular mechanism for plasticity seems to be escaping our grasp, with an ever-expanding list of involved molecules. I will introduce this picture and our effort to construct the complete signalling pathways. The complexity could be what is needed for the robustness and flexibility of organic systems, and thus OC design is not to intimidated by large systems.	learning, synapse, robustness	Mon, afternoon