

Complex Systems and Co-Operative Action

Research Seminar in the Module 10-202-2309
for Master Computer Science

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The Notion of a System

The concept of a *system* plays a prominent role in computer science when it comes to database systems, software systems, hardware systems, accounting systems, access systems, etc.

In general, computer science is regarded by a majority as the "science of the *systematic* representation, storage, processing and transmission of information, especially their automatic processing using digital computers" (German Wikipedia). Also certain relevant professions such as the *system architect* are in high esteem by IT users.

Seminar Orientation

However, the significance of the concept of system extends far beyond the field of computer science – it is fundamental for all engineering sciences and as *Systems Engineering* with the ISO/IEC/IEEE-15288 standard "Systems and Software Engineering", it is also the subject of international standardisation processes.

Even more, the concept of systems also plays an important role in the description of complex natural and cultural processes – for instance in the concept of an *ecosystem*.

Seminar Orientation

While classical TRIZ focuses strongly on instrumentally feasible engineering solutions, Systems Engineering

is an interdisciplinary field of engineering and engineering management that focuses on how to design, integrate, and manage complex systems over their life cycles. At its core, systems engineering utilizes systems thinking principles to organize this body of knowledge. The individual outcome of such efforts, an engineered system, can be defined as a combination of components that work in synergy to collectively perform a useful function. (English Wikipedia)

Management of Systems' Changes

In the winter semester 2019/20, we had already studied more intensively different system concepts and, in particular, examined their application in complex socio-ecological, socio-economic and socio-technical contexts.

We observed that the central concepts of *transition management* and *activity management* addressed two different perspectives on structural change processes.

In the transition management approach, the structural-transitional challenges are in the foreground, the activity management approach studies the implementation of structural changes via the actions and co-actions of actors and stakeholders.

Management Theories and Contradictions

In both approaches, however, the focus was on a holistic-structural and analytical view of a *decision preparation* rather than on practical procedural management approaches of *decision-making* and decision implementation in complex and contradictory real-world situations.

The WUMM project (WUMM stands in German for "Widersprüche und Managementmethoden" – contradictions and management methods) aims at a better understanding of such management processes.

Our starting point is TRIZ as a systematic innovation methodology derived from engineering experience in contradictory requirement situations.

Today, similar demands for an experience-based *systematic* approach are also addressed in the field of management, which means that engineering approaches and admissions are also there on the agenda.

Seminar Orientation

With the field of "Business TRIZ", which has been unfolding for about 20 years, this transfer of experience is being actively promoted, embedded in older management cultures and approaches.

In recent years, co-operative action by differently specialised experts has become increasingly important.

In such interdisciplinary work contexts, the development of *common conceptual systems* of sufficient performance proves to be a difficult problem that can be supported by digital semantic technologies.

Parallel to these challenges *agile approaches* play a major role in recent years, not only in the field of management, but also increasingly in the solution of socio-technical and engineering problems concerning ongoing co-operative actions in multi-stakeholder contexts – for example with the concept of *technical ecosystems*.

Seminar Orientation

In the seminar, we want to learn more about traditional approaches to management theories (F. Taylor, R. Ackoff, P. Drucker, H. Mintzberg) and relate this to developments in the area of Business TRIZ.

We are particularly interested in the connection between the dialectical resolution of contradictory requirement situations in the sense of TRIZ methodology and the emergence of common conceptual and notational worlds as a result of the application of suitable semantic web technologies.

A special emphasis will be put on the work of the *Methodological School of Management* and the Moscow Methodological Circle around G.P. Shchedrovitsky.

Seminar Organisation

The seminar is a **research seminar** in which we jointly explore different aspects of co-operative action in different management concepts.

With this seminar, we are approaching a topic that is new to us, which offers the opportunity to participate in a joint academic explorative process on a basis of equals.

This bears opportunities, but also challenges. The students are expected to actively participate in the seminar through seminar discussions, presentations and last but not least by reading the relevant materials.

For the successful completion of the seminar, a topic has to be presented in the seminar as discussion leader and a handout of 2–3 pages on the topic has to be submitted in advance.

Seminar Organisation

The seminar will be held weekly on Tuesdays 9-11 a.m. (Leipzig time) synchronously online.

Prior to each appointment participants have to study the assigned reading to be in a position to discuss the problems in the seminar.

The seminar is moderated by a *discussion leader*, who prepares a short handout of 2–3 pages and makes it available to the participants in advance *before the seminar* (by Sunday evening).

Students of Leipzig University find more about the seminar in the Saxonian e-learning platform OPAL – Course S21.BIS.SIM. The platform will be used for organisational purposes only.

The **primary source for the seminar plan** is the (actual version of the) file `Seminarplan.md` in the Summerterm-2021 folder of the github repository *Leipzig-Seminar*.

Course Structure

The course includes

- A lecture "Modelling Sustainable Systems and Semantic Web"
- A seminar "Complex Systems and Co-Operative Action"
- A TRIZ practical course.

Note that the access to the e-learning system used in the TRIZ practical course is subject to a fee. Details can be found in the forum of the OPAL course.

The Lecture

In the **lecture** *Modelling Sustainable Systems and Semantic Web* (Thursdays 11-13 a.m.) important concepts of our previous interdisciplinary course programme such as

- technology as a unity of socially available procedural knowledge, institutionalised procedures and private procedural skills,
- sustainability requirements in systemic concepts,
- digital changes and concepts of semantic web technologies,
- concept and knowledge formation processes,
- cooperative action, network economies and open culture

will be developed in more detail.

The lecture and the seminar are not directly related to each other, but conceptual frameworks developed in the lecture will be heavily present in the seminar.

Organisational Matters

These course parts can be taken for credit in various combinations

- 1) All three parts as In-depth Module 10-202-2309 (10 CP)
"Modelling sustainable systems and semantic web".
 - **Prerequisites for examination:** successfully completed seminar and practical course.
 - **Examination:** oral examination (30 min)
- 2) Lecture and seminar as Seminar Module 10-202-2312(5 CP)
"Applied Computer Science".
 - **Prerequisite for examination:** successfully completed seminar.
 - **Examination:** RDF project and home work paper.

Organisational Matters

- 3) The practical course alone as Module 10-202-2012 (5 CP)
"Current Trends in Computer Science".
- **Prerequisite for examination:** successfully completed practical course.
 - **Examination:** oral examination (30 min)

More about this in OPAL

<https://bildungsportal.sachsen.de/opal> in the course S21.BIS.SIM. There, please enrol first in the course and then in the corresponding group.

You can access OPAL with the data of your studserv account.

Organisational Matters

You will find a more detailed lecture concept in the github repo <https://github.com/wumm-project/Leipzig-Seminar> in the folder Summerterm-2021.

Data protection

We follow an Open Culture approach not only theoretically but also practically and make course materials publicly available. This also applies to the course materials you have to produce (presentations, seminar papers) as well as to (annotated) chat sessions of the seminar discussions, in which your names are also mentioned. **We assume your consent to this procedure if you do not explicitly object.** The discussions themselves are not recorded.

Organisational Matters

- Lecture: Thursdays 11:15-12:45, synchronous digital
- The Flipped Classroom Concept
- Continuously updated lecture plan and list of references in the Lecture/README.md file in the github Repo. See also the
- Further (mainly organisational) information also in the forum of the OPAL course.
- Seminar: Tuesdays 9:15-10:45, synchronous digital
- All events online in the BBB room BIS.SIM,
<https://meet.uni-leipzig.de/b/gra-w2c-fhz-qnp>

Questions ?