Oliver Mayer

TRIZ-Anwendertag 2022

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Welcome to Anwendertag 2022

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Dear colleagues and friends!
It is an honor and a privilege to greet you at Anwendertag 2022. This year we had the possibility to meet again in person, which improves networking and exchange on TRIZ topics in an enjoyable environment.

After having expanded the concept of the TRIZ Anwendertag in 2020 by adding to the practitioner day a second conference day with more academic focus, we received lots of positive response. That is why we are very happy to repeat and improve this format in 2022. We received high-quality papers, most in English language. This gives an international access. Presenters were from academia, big companies, small companies, and consultants. They provide an insight on their actual topics.

We are very happy as well that the International TRIZ Association – MATRIZ is supporting our event as well. This is an Acknowledgement of the quality of contributions that Germany delivers to the international TRIZ community.

Bayern Innovativ GmbH as a promoter of Innovations in Bavaria and beyond has supported the Anwendertag 2022 as well with accommodation and organization in their facilities.

We want to thank all authors and co-authors for their contribution to the conference. We are very aware of the amount of work that is standing behind each paper.

Also, we would like to thank the Paper Review Committee, for their valuable time to do a critical evaluation of the submissions and for giving valuable feedback to the authors in order to maintain the high-quality of the papers.

Behind the scenes the organization committee made an amazing job to have the conference run as smooth as it was. Thank you very much for that.

Oliver Mayer

Robert Adunka

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Modelling of Software and IT systems in TRIZ

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Summary. Software and IT systems have long become an irreplaceable part of our world. While methods from the software world such as Scrum have enriched classical engineering, there are always questions from TRIZ users as to whether and how TRIZ could be applicable as an engineering methodology for this. The same applies to IT systems. Here, too, there are doubts or objections because the basic concepts of classical TRIZ were formulated before the digitalization era. This is a first step in finding approaches to consider software and IT systems as equivalent engineering systems that can be processed with TRIZ tools and seamlessly harmonize with TRIZ concepts and results. With the starting point of the inherent connection of logical and physical layers in computer systems, the authors will start to show that software can be used as a component in functional analysis and that software itself can be the subject of analysis with functional analysis for products. For IT systems, we start considerations of what a minimal complete IT system can look like using the TRIZ approach. The motivation is that a conceptual perspective that enables consistent modelling of mechanical and IT systems will alleviate the problems faced by educators and practitioners in the field and increase the acceptance of TRIZ in the IT industry and communities. We want to emphasis, that this publication is a first thought on the task that will have to be detailed in further papers, e.g. at ETRIA or TRIZfest.

Keywords: TRIZ · Functional analysis · IT systems · Hardware · Software · Data · Flow analysis · Information technology modelling · IT modelling · Functional analysis for processes · Functional modelling for software · Software development

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Despite the large number of publications and reports on the successful application of TRIZ in the field of IT and software development [1–5], the authors are repeatedly confronted with questions and doubts from TRIZ users as to whether and how TRIZ can be of use in the modern world, especially when it comes to IT systems and specifically software. Due to the origin of TRIZ in the era of mechanical engineering and the associated formulations of some classic TRIZ tools or from examples in the literature, newcomers often have doubts as to whether TRIZ is suitable for modelling IT or software.

One of the purposes of this paper is open up an approach and to start a discussion on how IT and software fit into the TRIZ world. According to the definition in [6], software is a computer program, a procedure and possibly related documentation and data concerning the operation of a computer system.

A second aim is to demonstrate an approach to the systematic modelling of IT systems in TRIZ. IT systems as we know them today are usually described as consisting of hardware (computers) that process data under the control of software (programs). The main difference between these building blocks is that programs and data are immaterial entities.

Several authors have already addressed the topic of applying TRIZ tools to software or computer systems in general. A comprehensive overview of software-related work is given in the paper [7], which includes almost 30 publications published between 1999 and 2014. It also provides an analysis of the current state, including the main problems in applying TRIZ to software engineering and some predictions for this field. Other interesting publications deal with functional modelling [8, 9], substance-field modelling [10], the transfer of the 40 principles of invention to the IT domain [11] and the laws of evolution of information systems [12].

The definitions of *function, component* and *parameter* found in selected reputable sources are sometimes misleading. If one analyses the sources, one finds that some terms are missing, and some differ significantly in scope or approach. The definitions from the MATRIZ-approved sources seem to be the most compatible, but still [13, 14] require objects to be *material,* while in [15] this adjective does not occur. Although there are also some differences between the definitions of *substance* and *field,* the sources generally agree that a substance has a rest mass and a field has no rest mass.

A rest mass clearly corresponds to the material nature of a substance, but how can a field be perceived as a material object if it has no rest mass and contains no matter? When we try to identify the components of an IT system, it seems reasonable to consider hardware as substance while software and data should be fields. Thus, if one insists that a field must be a material object, the conclusion seems obvious: neither software nor data can be a legitimate system component (and such a statement is reportedly presented during some TRIZ workshops).

The first viable solution to this puzzle is to delete the adjective "*material*" from the definitions of component and function, as was done in [15], to remove doubts about a material domain. The second way is less obvious, as it requires rethinking the intended meaning of this adjective. Although it is not emphasized in the international literature, TRIZ stems from the materialist and dialectical worldview [16]. Therefore, the adjective "*material*" in the above definitions should be interpreted as *objective, measurable and capable of interacting with other entities* rather than *being*