Teaching TRIZ within Siemens
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Within Siemens 163 people had an introduction to TRIZ with at least a half-day seminar. There are 41 people that had a Basic training for five days. The Basic Training is the equivalent to the MATRIZ Level 1 Certificate. Just eight people taken the Advanced Course (equals MATRIZ Level 2) up until now.
All those participants gave a feedback on the TRIZ tools they learned about on the course in a very comprehensive survey. They also judged the examples that were used within the course to illustrate the different teaching topics. This paper shows the outcome of feedback given by 191 engineers on different TRIZ tools. It will elaborate on the examples used and how the understanding of the examples could be linked to the topics taught. It will also show how the tools build upon each other and how many days were spent teaching these topics. Therefore this paper will give TRIZ-teachers hints, on how to build up their lectures and which topics they should teach first.

Early Experiences Employing the Matrix Principles Modified for the Communications and Electronics Domain
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Different authors have developed examples of the TRIZ Principles in a number of domains ranging from finance to microelectronics. To the authors knowledge, no one has attempted to develop examples for the 40 Principles in the electronics and communications domain. Also past authors have seemed reluctant to explain how the examples were derived. This paper explains how the examples were obtained systematically by interviewing a number of domain specialists who knew little of TRIZ. In fact experience of trying to explain TRIZ before the knowledge capture phase, proved highly problematic and weakened the task focus. A condensed list of the 40 Principles is included.

Cognitive Foundations of TRIZ Problem-Solving Tools
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This paper considers the cognitive foundations of TRIZ tools. It analyses reasons for the effectiveness of TRIZ tools in directing users to achieve superior solutions. The cognitive bases for application of the systematised Substance-Field analysis, Method of the Ideal Result, Situation Analysis, the 40 Innovative Principles as well as the Contradiction Table are considered.

Application Characteristics of the Law of System Completeness

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Some aspects of the Law of system completeness appearance in technical, information and economic systems are considered in the report. The main system elements revelation technique including a set of criteria for checking of model adequacy to a real system is being proposed. Special attention is being paid to control parameters and control element revelation and its relation with background. A lot of examples are analyzed. It is considered a way of mistakes avoiding while main system elements revealing and mistakes of following analysis.

The integration of TRIZ and Risk Management to Increase the Ratio of Success of innovation Projects

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This paper explores the interaction of project risk management and TRIZ in innovation projects. We started with this paradox: when we generate brand new solutions to existing problems, almost no information is available; however, such information is necessary to evaluate the innovation project success probability. The potential and the cost of a conceptual idea are much more difficult to evaluate than for detailed solutions. This difficulty can let solutions in a drawer . In this article we tackle the difficulty to reliably evaluate probability of success of innovation projects, using an adapted risk management strategy.

Applications of Innovative Methodologies and IT tool to Support European SMEs in Product Innovation Processes

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The systematic support of the innovations process in small and medium-sized enterprise (SME) is still is a challenge because innovation is only done sporadic and often with external consultancy in order to gain sustainable competitive advantages. This paper describes a methodology to cover the conceptual development of new products, which is typically structured in the a number of specific steps and introduces an IT-tool that provides the transition from isolated tool support towards an information management along all the phases of the conceptual development in an innovation process. The application of the method in a use case is explained as well.

The Engineers Innovation Toolkit
G. Maarten Bonnema
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Most engineers nowadays receive a mono-disciplinary education: Mechanical engineering, Electrical engineering etc. Contradictory, the products they have to design are ever more multidisciplinary and integrated. This requires a different mindset. This paper discusses four tools that fit in the engineers toolkit to approach these multidisciplinary problems: TRIZ, Systematic Inventive Thinking, Quality Function Deployment and FunKey Architecting. The tools are discussed and rated on four scales: difficulty of problems, complexity of problems, design phase and learning effort. From the characterization a set of heuristics is derived that help in choosing the appropriate tool from the toolkit. It is concluded that the four tools largely complement each other and should therefore be part of every engineer s toolkit.

TRIZ Value Innovation Roadmap for Projects Innovation Roadmaps
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In this paper we will show our experience and best practices of many innovations team around the world in TRIZ application for different kind of projects and problems. We will focus your attention on how to use all modules of TRIZ as a complete and harmonic system in combination with others proven methods. We call this composition as a TRIZ Value Innovation Roadmap. We use TRIZ Value Innovation Roadmap as a base for each unique project

TETRIS: Teaching TRIZ at School Meeting the educational requirements of

heterogeneous curricula

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Enhanced creativity, problem setting and problem solving skills are missing topics in most of secondary schools of the European countries. Besides, actual TRIZ courses, seminars and educational materials are mostly tailored for industry or technical universities while they fail to meet the requirements of many different potential readers and learners from general upper-secondary school students and teachers to people interested in human science disciplines.
The TETRIS project, funded by the European Community within the Lifelong Learning Program, aims at producing and testing TRIZ educational material suitable for learners from 14 years old onwards following any kind of curriculum. The paper presents the goal and the structure of the project, dedicating a proper attention to the description of the identified educational requirements and to the approach followed to build the Body of Knowledge of the educational material.

Networks of Trends: Systematic Definition of Evolutionary Scenarios

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TRIZ literature presents several papers and even books claiming the efficiency of Altshuller s Laws of Engineering System Evolution as a means for produce technology forecasts. Nevertheless, all the instruments and the procedures proposed so far suffer of poor repeatability, while the increasing adoption of innovation as the key factor for being competitive requires reliable and repeatable methods and tools for the analysis of emerging technologies and their potential impact. The present paper proposes an original algorithm to build a Network of Evolutionary Trends for a given Technical System with repeatable steps. Such a goal has been achieved by integrating well known models and instruments for system description and functional analysis. The overall procedure, still under further development, has been clarified by means of one of the case studies carried out for its validation.

On Contradiction Clouds

Denis Cavallucci, François Rousselot, Cecilia Zanni

INSA Graduate School of Science and Technology, France

Our proposal, through this article, addresses the issue of obtaining, representing and selecting the appropriate subset of contradictions among a complete set of contradictions resulting from an initial situation framing within a specific domain. This contribution has to be understood within the Inventive Design context since most of its grounding relies on the fact that any problem can be formulated as a contradiction (in the sense of TRIZ). By proposing the concept of "contradiction cloud" as an element of representation of a set of elementary contradictions we claim that designers considerably reduce the fuzziness of a contradiction choice prior to entering in a solving phase in Inventive Design processes. The modes of interpretation of this cloud will be also presented. The impact of this new element in the teaching of TRIZ was tested both in educational situations within the framework of our engineering curriculum and in several industrial partnerships. A discussion section will then highlight the assets, the limits and the perspectives of our contribution.

SIMPLICITY in TRIZ related INNOVATION METHODOLOGY Implementation: 4 novelties
Simon Dewulf, Vincent Theeten, Bernard Lahousse
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1)Distillation of consumer data out of patents
Patents describe solutions to problems. A large part of the problems are consumer problems (as opposed to production problems). Whatever the quality of solution, the problems are well described. For domains where consumer research is challenging (B2B) patents offer a new source of consumer problem mining. Over time; patents reveal its trend in problems or its evolution.
2) TRIZ states to look outside, where?
One of the foundations of TRIZ is to look across domains for existing solutions. The paper proposes a method to generate a series of domains that are related to the subject at study. Once the "DNA" of a domain, product or process is identified, an automated algorithm generates a series of "family" domains.
3) Out of the box in time and space
Generation of the TRIZ 9 windows based on patent data largely automates the charting out of all elements in time and space.
4) What's being changed, what's being gained
Based on the analysis of patent domains generic changes (increase, decrease, stabilize) are detected over time. The research identifies trends in technology variables i.e. properties or functions at study.

Teaching TRIZ to Beginners
Ellen Domb
PQR Group, USA

Many people who could benefit from the methods and concepts of TRIZ have rejected it because they were confused by the way TRIZ was taught. Expertise in the method does not necessarily make one a good teacher for beginners. Methods for adult education have been well-researched in the last 50 years, and they can be used to create a robust TRIZ teaching system that is useful in many cultures. Case study examples of application of TRIZ to the development of TRIZ training methods will be demonstrated.

TRIZ-ARIZ in transformer-type fault current limiter development
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In this paper I present a way to come to possible solutions for present problems in the development of transformer-type fault current limiters with using TRIZ and ARIZ methods. The aim of this study was to examine the use of TRIZ and their tools in a real development process and to suggest future improvement targets to include TRIZ into inventive engineering problem solving. I concluded that TRIZ can help find solution ideas effectively but combination with other methods and tools is required to help other steps in the engineering problem solving process. A system should be handled as numerous and interconnected requirements, parameters, problems and solutions, and step-by-step method, similar to ARIZ, should be developed to go through the conceptual design phases.

Function Approach for Resource Analysis
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This paper demonstrates the importance of Resource Analysis in modern TRIZ and provides an overview of existing findings regarding resources. The main goal of the paper is to suggest an approach that can be used for the identification and evaluation of resources. The advantages of the developed approach are as follows:
- Practicality: the suggested approach is focused on the rapid development of workable ideas without significant effort.
- Efficiency: the suggested approach is based on recommendations of proven TRIZ tools, such

as ARIZ, Trimming and Function-Oriented Search.
- Simplicity: the suggested approach is quite understandable and can be used by everyone who has a basic knowledge of TRIZ.

Further Development of the Trends of Evolution Trend of Sustainability Increase
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Trends of Engineering System Evolution (TESE) are statistically proven directions of Engineering System (ES) development. They describe the natural transition of Engineering Systems from one state to another. These directions are statistically true for all categories of Engineering Systems.
TESE, their mechanisms and tools are in the focus of TRIZ development these days. Major factors that drive the development of products through TESE are requirements of the supersystem.
An important requirement that has emerged lately is a requirement of sustainability. The article describes a new step in TESE development Trend of Sustainability Increase: in the process of the evolution of ES the degree of its sustainability increases. The sustainability here includes multiple factors recycling, reuse, etc.
A number of mechanisms (sub-trends) have been also discovered. For example, a sub-trend: non-recyclable - recyclable material - several recyclable materials - reusable parts modification - using parts with no modification.

Revising the TRIZ-based Business Idea Database to Find Customers Potential Needs on Business and Technical Seeds to Resolve Them
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The business idea database released in 2003 which used 40 principles of invention and the contradiction matrix suggested solutions of business problems from their essential subjects and contained contradictions. To improve effectiveness, it is revised with two points of view. One is that business contradiction statements for reminding unconscious and potential business problems are introduced. The other is that requirements analysis and definition techniques of software engineering and Enterprise Architecture framework are applied for finding technical seeds from suggested business ideas. The revised business idea database can be effective in finding unknown business needs and hidden technical seeds.

TRIZ Contribution to the Solution of the Paradox During Homogenization of Molten Glass

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Homogenization of molten glass before hot forming is one of the most important operation for achieving high quality of glass. Homogenization is provided mainly by a mechanical way (mixing by stirrers) which has a lot of disadvantages and problems. Nevertheless, it is most effective way at present. For a long time tests with thermal mixing are being made which means a better motion of molten glass by the change of temperature is being searched. There exist a lot of patents and a lot of implementation of equipment. However, the effectivity of mechanical mixing is not reached yet.
Also the trends of evolution of the TRIZ method predict that the transition from mechanical to the thermal field should be more effective. Therefore, this forms the paradox of the glass homogenization development. TRIZ method analysis helped to find the reason of lower effective thermal mixture at present and designed idea to overcome this paradox. The demonstration of this analysis is the subject of this article.

Design Methodology for Hybrid Production Processes

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Current developments of hybrid production processes or production systems exceed the performance in manufacturing. They focus on special applications, such as laser-supported turning of ceramics or ultrasonic-assisted milling of dies. Most of these developments have in common that they have mainly been found intuitively. Up to now the development of new hybrid production systems leads to high amounts of operative planning. Furthermore hybrid processes often operate far from their optimal capabilities. The challenge is to develop a systematic and scientific approach for aggregating, describing, explaining and combining single processes. This paper introduces a systematic approach of the design methodology for developing hybrid production processes. The ontology of hybrid production processes is illustrated as well as their potentials in comparison to single processes. Different kinds of models are shown, that are used within the methodology to identify and explain the limits of existing single production processes by the means of abstract contradictions. In terms of identifying hybrid process solutions as part of an innovation process, the applicability of different TRIZ tools is shown concerning the specific requirements of manufacturing processes development.

Logistic Substitution Model and Technological Forecasting
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In this paper the application of several models, based on logistic growth function (simple logistic, component logistic and logistic substitution models) in contexts of technology change forecasting is discussed. The main thought of this paper is to revise existing models and arrange working hypothesis for future research. First, the features of simple logistic model are presented. Different types of competition are discussed. Component logistic model is presented in short. Second, the review of logistic substitution models in context of long-term technological forecasting is discussed. Third, some hypotheses about how to improve reliability of logistic substitution model for study the technological future are proposed.

From Knowledge to Sustained Revenue Building a Business Model
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This article is based on experience and thoughts on adding value in a business environment. Mantra s like make a lot of money or beat competitors will not do in the long run when looking at flow of resources. Over focussing one resource is drying out other resources. Resources needed to survive and grow.

Using TRIZ to Overcome Vision and Target Failures
Ido Lapidot
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Setting organization vision and targets base on TRIZ basic concepts, can serve an organization in building prosper culture, avoiding traps of group thinking in single domain and group psychological inertia. Vision should be based on Ideality, while Targets should be based on Value equation expressing both the nominator and denominator if the equation therefore driving the organization for continually increasing its value.

Wisdom of Creating You Learning Through TRIZ
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A lot of people have been fascinated by this surprising TRIZ methodology because of its affluent analogic clues and its intangibility in the process of problem solving. Nevertheless in reality this surprising tool had not been widely accepted as a problem solving tool. What made it happen? The main reasons can be divided into two catogories; jumping into contradiction at initial stage little understanding of TRIZ just as idea generation tool. It is clear that emphasizing contradiction without problem analysis make extracted conceptual solutions more ambiguous. Nevertheless, TRIZ experts shout, what is your contradiction? Absolutely I agree that TRIZ methodology can generate breakthrough idea not in the subordinate relationship but in the reversed relationship. But management wants to touch inout value of TRIZ results. Where is your Breakthrough idea? The above two sentences are TRIZ killers. This article introduces creating new success story of TRIZ at POSCO including newly developed TRIZ Roadmap and a case study.

Method for Quantitative Evaluation of Innovation Tasks for Technical Systems, Products and Processes

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The paper is addressing the main needs of the industrial sector regarding early stages of innovation process, product development and inventive problem solving. The proposed method includes a formalized identification and quantification of system functions and properties as well as of corresponding innovation tasks. For each identified function the level of its current performance, priority and measurable value of its innovation potential are estimated. A new approach is proposed for calculation of the ideality level of technical systems. Method is illustrated by example of its application for innovation concept development of a packaging line for food industry. Opportunity for identification and quantitative evaluation of innovation tasks for processes and for non-technical systems is outlined.

Smart Materials Solve Contradictions: Connecting The Right Materials Solution To The Right Market Need

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In the paper, we propose that the primary value of any smart material comes from its contradiction-resolving abilities, and that the key to successful commercialisation of any smart material involves making the right links between a contradiction-solving material and a market need for that contradiction to be solved. The paper is divided into two halves. In the first half of the paper we discuss the theoretical basis behind the contradiction-resolving importance in the innovation story and show that while it is already clear that a number of smart materials are technically ready for the market, it is rather less than clear that many markets are ready for them. In the second half of the paper, the attention turns to a number of mini-case study examples showing how smart material capabilities can and have been matched to real contradiction-eliminating market needs.

Creating A Meta/Mega/Micro Market Trend Hierarchy: Trying To Understand Populations Better Than Populations Understand Themselves

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The paper describes the main outputs from a long-term piece of research aimed at finding the underlying patterns in the thousands of observable consumer and market trends present in the world at any one time. By applying TRIZ principles, we describe for the first time how it has now been possible to find an underlying structure behind these trend patterns. The first part of the paper describes this structure. It is here we demonstrate a hierarchical pattern of inter-connected and inter-dependent meta, mega and micro level trends. Using this structure, then, as its foundation, a second part of the paper goes on to show how key aspects of the structure repeat and recur in a highly predictable manner. In this second part we thus show how rather than simply being a means of describing what has already happened, we are able to turn the story into one making more solid predictions about things that will happen in the future.

Technological Route between Pionerism and Improvement

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Scinte s.n.c. Ranica, Italy

This paper presents a systematic approach to determine the technological route between: - discovery, pioneering, radical creation; - qualitative or quantitative improvement; as the two extremities of a line passing through a specific patent taken alone, or a group of patents

re-garding a certain inventive theme. The technological route is the result of a iterative procedure based on a use of a patent search engine capable of: Browsing Codes according to International Patent Classifications, and Clustering Texts to ex-amine search results using linguistic technologies. Said iterative procedure consists of: - determining the initial search algorithm as the expression of pioneering and radical creation, based on the characteristics of reference patent or group of patents; - applying a clustering algorithm to results of the above initial search algorithm; - comparing the clustering search results to the characteristics of reference patent or group of patents; - updating the clustering algorithm according to the characteristics of reference patent or group of patents; - repeating the procedure reapplying the updated clustering algorithm till the step of convergence to a technological route is considered no relevant; - storing the final search algorithm as the expression of qualitative or quantitative improvement.

Applying TRIZ/USIT to A Social & Technical Problem: Auto-locking Door System of Apartment Building

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Students' discussions were guided with TRIZ and USIT to solve an everyday-life problem. The security problem of auto-locking door system of apartment building needed to be solved in the human psychology and social behaviour first and then must be ensured in the technology. Mechanical & physical system of door has been shifted to IT & logical system.

A Taxonomy of Inventive Principles for Robust Design Concepts

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This paper describes the evolution toward a taxonomy of inventive principles for achieving robustness during concept design phase. Robust design is a set of scientific principles used to design products and services so that they perform the intended functions with minimum amount of variation under broadest range of usage conditions possible and for longest period of time possible. The proposed taxonomy of inventive principles for generating robust design concepts are derived by using a research methodology similar to that employed by Altshuller in developing the Theory of Inventive Problem Solving . The taxonomy is based on the concept of P-diagram or parameter diagram. Based on P-diagram elements, nineteen strategies were identified based on the analysis of about two hundred inventions.

How to Prevent Product Piracy using a new TRIZ-based Methodology
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In recent years, product and brand piracy has significantly gained importance and risen to a worldwide mass phenomenon. Focusing on this issue, the paper introduces a new TRIZ-based methodology, the so called Product Piracy Conflict Matrix (PPC Matrix). The methodology has been designed to help companies to overcome a typical conflict, when it comes to developing non-legal protection schemes and implementing them into a running business: on the one hand, a burdened company quests for powerful protection strategies for its products or brand. On the other hand, the implementation of these strategies must not require excessive modifications to the considered product respectively the product s value chain. The PPC Matrix methodically resembles the well-established TRIZ Contradiction Matrix and is also based on Neemann s work (2007), who recently introduced a new approach for product-based imitation protection including a set of technical, strategic, organisational and legal instruments. The PPC Matrix combines both approaches to a new framework to help companies to overcome the above mentioned conflict. The article introduces the new methodology by giving detailed insights into its theoretical backbone, providing practitioner s guidance and outlining examples from industry practice.

Strengthening the 40 Inventive Principles.
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This article consists of 2 parts. The first part investigates the formulation of the 40 Inventive Principles, one of the classic TRIZ tools. We compare the 40 Inventive Principles from different TRIZ sources in English as described in books or software and point out the differences such as incompleteness of some principles, different words used in the translation to English etc.
The second part consists of suggestions to improve the 40 Inventive Principles. Since language triggers thoughts, different meanings can create different interpretations. In order to get a more uniform language we suggest alternate 40 Inventive Principles where the used terms are in accordance to a systemic view. We investigate different approaches to get a more forward use trying to make the principles as less abstract as some of them are without fundamentally changing the 40 IP. We also aim to simplify the application and strength of the 40 Inventive Principles by splitting it up into a resources part and recommendation part. Finally the split up is applied to an example.

Value-Conflict Mapping (VCM) To Structure Innovation Strategy
Valeri Souchkov
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The paper presents an overview of key concepts of Value-Conflict Mapping (VCM), developed to help with collecting and structuring information about existing and potential problems in various types of man-made systems in a systematic way. These problems are represented in terms of contradictions between market and/or business demands caused by current system properties or parameters which often must have opposite values or be in opposite states to satisfy two or more different demands. A procedure of value inversion is introduced to extract more information about demands and contradictions. The paper also shows a general process of Value-Conflict Mapping and is illustrated by several examples.

TRIZ Incorporating the BRIGHT Process in Design
Shuo-Kai Tsai, Peter R.N. Childs
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The theory of inventive problem solving (TRIZ) is widely acclaimed by adoptees and in the academic literature. However, an apparent disparity exists between the low reported industrial take-up of TRIZ and perceptions in the TRIZ community which indicate more widespread use. A review of TRIZ, design processes and creative problem solving processes are reported, showing differences in the emphasis on creative thinking and the use of iteration. The advantages of a procedure related to the aspects of usability, creative thinking and iteration within the TRIZ environment has been recognised and addressed by the development of a new process named BRIGHT.

A Study on Pointers to Effects for Non-technical Problem Solving
Hongyul Yoon
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Solving process of non-technical problems requires knowledge different from that of technical problems. Almost all of TRIZ thinking tools can help solving non-technical problems but, in this case, the efficiency and effectiveness of TRIZ seem much lower than the case of technical field. Absence of pointers to effects for non-technical problem solving could be the main cause of it.

In order to develop some pointers for non-technical problem solving, the structures and meaning of □function model□ and □effect□ were discussed. Based on the discussion, some pointers to effects are proposed for human-targeted problem solving.

Searching for Similar Products through Patent Analysis

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During problem solving, TRIZ users map a specific problem to a generic problem, solve it via TRIZ tools, and map back to a specific solution, a process relying heavily on their TRIZ skills. To aid less skilled users, a methodology and algorithm are proposed that, through identification of specific word categories in patents, analysis of co-occurrence data, and data mining techniques, automatically identify similar products, and properties relating or differentiating products. This algorithm can quantifiably guide creativity efforts and aid in patent portfolio management.

Development of a Framework for Using TRIZ in a Co-disciplinary Design Environment

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The work that is described in this report consists of creating a framework for facilitating the use of TRIZ in analysing and solving mono- and co-disciplinary design issues during design of electromechanical products at a large company in the Netherlands. Guidelines have been developed that serve as a strategy for implementation of this framework against the background of (co-disciplinary) design issues. The guidelines are based on interviews with employees from different disciplines, and lessons learned from a previous attempt at introducing TRIZ. Both for the development of the framework as well as for the testing thereof intensive case studies were used. As the case studies contain many company proprietary details they cannot be depicted in this article; consequently the paper will remain focussed on the framework developed.