Conference Program

1st day (November 4th): 'Politehnica' University, Piata Victoriei 2 (Senate Room)

08:30-09:00 **Registration**

09:00-10:30 **Basic tutorial:**

Prof. Gaetano Cascini, Politecnico di Milano, Italy

10:30-10:50 **Coffee break**

10:50-12:30 **Advanced tutorial:**

Alexander Narbut, FRT Corporation, Kiev, Ukraine

12:30-14:00 **Lunch:** Lloyd Restaurant, Piata Victoriei 2

14:00-14:20 **Opening session**

14:20-15:10 **Industrial keynote:**

The Role of Patent Information in Technology Roadmapping and Competitive Intelligence
Dr. Stephen Taylor, Consorzio per l'AREA di Ricerca Scientifica e Tecnologica Padriciano, Trieste, Italy

15:10-16:10 **Industrial & practitioner session:**

How to Prevent Cords and Cables from Getting Entangled: A Study of Systematic Classification of Various Solutions
Toru Nakagawa, Tomoyuki Itoh, Masanobu Tsukamoto, Osaka Gakuin University, Japan

Cords and cables often cause troubles by getting complex and entangled, around appliances at home, around PCs at offices, around equipments in labs, etc. The present study started to think of methods of preventing cords and cables from getting entangled. Since the problem lasts so long and spreads so widely, there must be a lot of different solutions known and used in the world, we thought. Hence, as an educational case study, we set our goal to collect different solutions and build up a hierarchical system of solutions to this common problem. Classifying/categorizing solutions has fundamental significance in systematically understanding the whole solution space.

We first searched for various methods, tools, devices, equipments, etc. which are used for such a purpose, at home, at offices, at hardware stores, at PC shops, etc. Then we classified all these cases, in a bottom-up manner into a hierarchical system of methods. Recognizing the need of a more systematic approach, we introduced the scope of the target system and expanded it stepwise. As the result of reorganization, we have built up a system of solutions to this problem, namely: (A) As for a cord or cable, to adjust its length so as not to get entangled. (B) As for multiple cords or cables, to bundle them, to combine and unite them. (C) As for the connecting parts between devices and cords/cables, to standardize them for easy connection and disconnection and to use simple connection modules. (D) As for the system containing devices and cords and cables, to reorganize the devices in their functions, structures, methods, and arrangements, and to set and store cords and cables in appropriate places.

Using TRIZ to Find Innovative Redesign Solutions for a Jigsaw
Ion Grozav, Felicia Banciu, George Drăghici, "Politehnica" University of Timisoara, Romania

This paper's aim is to present a set of solutions for redesigning the jigsaw. The paper covers the divergent creation phase, and it presents an abstract of technical contradictions and a solution using Su-Field analysis. The contradiction matrix and TRIZ inventive principles were employed to

established the possible technical solutions for the jigsaw. Once convergent creation phase is reached, the solutions generated in the divergent phase are analyzed and axiomatic design is then used to choose the solution with the highest probability of success.

16:10-16:30 Coffee break

16:30-18:30 Industrial & practitioner session:

Resolving Open Innovation Contradictions
John Cooke, CoCatalyst Ltd, UK
Darrell Mann, Systematic Innovation Ltd, UK

One of the foundation stones of TRIZ is the idea that 'someone somewhere has already solved your problem'. In this context, the emerging open innovation movement makes a lot of sense: present tough, unsolved problems to extremely large numbers of the world's most inventive minds and chances are someone, somewhere may either already have a solution or the wherewithal to deliver a solution. Look beyond a few well chosen 'low-hanging fruit' examples, however, and the distance between theory and practice begins to look like a rather large chasm. In fact, research conducted for this paper indicates that the chances of innovation success are no better if open innovation strategies are adopted or not. The paper discusses six issues common in open innovation, and in two cases suggests potential remedies through real case study examples taken from a range of different industry sectors.

A Study of Decision-Making Model to Evaluate "Index of Ideality"
Manabu Sawaguchi, SANNO University, Japan

My presented paper at ETRIA2007 referred to "Four patterns of Innovation". This time, I would like to introduce "Decision-Making Model (D-MM)" for "Innovation pattern 3 & 4" focusing on "High-End Customer (HEC)". In my opinion, "HEC" basically chases "Ideal Final Result (IFR)" from the point of view in TRIZ thinking. Therefore, in this paper, I want to define "chasing IFR of product" as "chasing highly-valued product".

As I mentioned in my previous paper at ETRIA2007, chasing "IFR" is one of big features about "Innovation 3 & 4". Consequently, proposed "D-MM" to be built here is to search "the Idealized Conceptual Designs (ICD)" to realize highly-valued product rationally from the standpoint of "chasing IFR".

To be concrete, based on TRIZ thinking, the concept of "IFR" is connected with "Evolution Towards Increased Ideality (ETII)". Because "Increasing Ideality" indicates that products (technical systems) are developed according to the "Direction" that "Useful Functions (UFs)" are increased and "Harmful Effects (HEs) "are reduced in time axis. As a result of "ETII" of an object product, it approaches "IFR".

In this article, as a beginning, I describe the relationship between "Innovation pattern 3 & 4" and "Proposed D-MM". Then, I refer to the features of proposal "D-MM" based on the concept of "IFR". The basis of the proposal "D-MM" is "Analytic Hierarchy Process (AHP)". To put it concretely, it is devised to evaluate "Ideality" from various aspects corresponding to not only "UFs (such as product design parameters)" but also "HEs (such as side effects with useful functions)". Based on "the Hierarchy Diagrams (it's called AHP hierarchy)", which focus on a series of "UFs" and "HEs" in an object product, the proposal "D-MM" is able to measure its "Index of Ideality". Finally, through one case example, I want to consider the effectiveness of proposed "D-M M".

The TRIZ Approach Applied o Vehicle System Design – Variable Valve Timing
Sebastian Koziołek, Mariusz Ptak, Wrocław University of Technology, Poland

The aim of this paper was to carry out the process of applying TRIZ in the vehicle system design by using its tools and techniques. Variable Valve Timing system was chosen as the field in which TRIZ has been approached. The TRIZ method was introduced and its unique capability to solve problems was contrasted with others inventive methods. Its technical aspects were also presented. To adopt TRIZ methodology and to achieve the objective the deep understanding of the system as well as the identification of the problem were needed. Therefore, this paper presents variable valve timing and compares it with the conventional valve train. Many TRIZ tools were used to overcome psychological inertia and negative influence encountered especially at the beginning of the work. Finally, the undertaken techniques enabled the feasible and novel Variable Valve Train mechanisms to be designed. The technical solution was implemented with the use of CAD [2, 6], and to be based on the 3D model the FEM [9] analysis was also conducted.

Innovative Design of a System of Temperature Control without the Correction Center
Corina Dana C. Cernăianu, University of Craiova, Romania

The paper presents the finite element analysis of the thermal effects of cutting on parts processed without correction in the center. There are presented the effects of high temperatures on structure changes, expansions and changes of superficial hardness and micro hardness. The paper presents methods for the automatic control of technological parameters of the process of grinding machines

with advance without center cross, in order to maintain the temperature influence on the processing elements within the normal technological parameters.

Best Practices in Applying TRIZ at Philips Royal Electronics
Christoph Dobrusskin, Philips Applied Technologies, Eindhoven, The Netherlands

In the past seven years we, at Philips Applied Technologies have consistently used TRIZ in our innovation process for various businesses at Philips as well as for external parties, and particularly in workshop settings, in which the participants are not generally trained in the use of TRIZ. Initially we have tried to use elements of TRIZ directly in the definition and ideation phases, but have met with some difficulties. We have subsequently developed a different way of integrating the systematics of TRIZ within the structure of our project settings, and based on our experience we will show how we integrate TRIZ in our innovation process, present our learnings and links to other innovation tools

19:30-23:00 **Traditional party:** Timisoreana Club XXI Restaurant, Piata Victoriei 2

2nd day (November 5th): 'Politehnica' University, Piata Victoriei 2 (Senate Room)

08:30-09:30 **Scientific keynote:**

Qualification for being innovation manager
Prof. Serge Tichkiewitch, Grenoble University of Technology, France

09:30-10:30 **Scientific session:**

TRIZ-Box – Improving Creativity by connecting TRIZ and Artifacts
Albert Albers, Tobias Deigendesch, Hannes Schmalenbach, Universität Karlsruhe (TH), Germany

The contribution proposes the application of artifacts for stimulation of analogy forming. These artifacts are related to the inventive principles of the TRIZ method. By formulating a contradiction based on Altshuller's parameters, a list of promising inventive principles is generated. The TRIZ-Box contains artifacts that represent these inventive principles physically. Access to the artifacts is provided by a web-based content management system (wiki), in which artifacts and related information can be searched and described.

Correlations between the Evolution of Contradictions and the Law of Ideality Increase
Niccolò Becattini, Gaetano Cascini, Politecnico di Milano, Italy
Federico Rotini, Università degli Studi di Firenze, Italy

TRIZ literature largely claims the efficiency of Altshuller's Laws of Engineering System Evolution (LESE) as a means for producing technology forecasts. Besides, all the instruments and the procedures proposed so far suffer from poor repeatability, thus limiting the adoption of TRIZ instruments as reliable means for the analysis of emerging technologies and their potential impact. In a previous work [1, 2] the authors have presented their modelling approach based on a combination of well known TRIZ techniques and traditional engineering design reference models. The outcome is a Network of Evolutionary Trends which supports decision making by positioning alternative technologies and technical solutions according to the LESE. The choice of the favourite strategic direction is still assigned to the beneficiaries of the forecast, since decisions will be taken also based on their mission and values. Besides, it is necessary providing further means of judgement to the decision makers. According to this purpose, it is useful to assess the maturity level of the analyzed technologies. The present work is a study about the correlations existing between the evolution of contradictions and the Law of Ideality increase, as a means to estimate the stage of development of a Technical System. The paper details the method proposed to make a systematic comparison of the contradictions related to each technology. The approach is clarified by means of a case study related to the production of tablets in the pharmaceutical manufacturing sector.

10:30-10:50 **Coffee break**

10:50-12:40 **Scientific session:**

Accessibility of the Innovative Principles to Further Levels of Abstraction in Product Development
Albert Albers, Manfred Ohmer, Thomas Alink, Karlsruhe Institute of Technology, Germany

The paper introduces the transformation of the 40 innovative principles of TRIZ into a description with the Contact and Channel Model (C&CM). Reason therefore is the attempt to make the principles better applicable for the generation of new ideas in product development at any stage of the product development process.

The paper in a first step introduces the C&CM. The core of the C&CM approach is an orderly assignment of the functions of a product to their shape, which enables designers to break up with rigid, pre-fixating representations of products. C&CM product models by means of Working Surface Pairs (WSP) and Channel and Support Structures (CSS) force users to think about products in a more abstract way. Designing with the C&CM is conducted on a meta level through (i) adding WSP, (ii) removing WSP, (iii) changing the properties of WSP and (iiii) changing the properties of the CSS. The paper reflects the reasons for the transformation of the innovative principles of TRIZ into C&CM before the theoretical approach is explained. The paper closes with a case study where the coupling of the innovative principles to the C&CM meta-rules of designing is applied.

An ontology for TRIZ
Denis Cavallucci, François Rousselot, Cécilia Zanni, INSA Graduate School of Science and Technology, Strasbourg, France

This paper discusses the usefulness of an ontology for TRIZ and is an attempt to provide its readers (researchers, industrialists, educators, students) with answers regarding elementary questions they may have concerning TRIZ groundings and potential uses. These answers have the main objective to clarify how they may locate their perceptions of TRIZ and more easily find a way to contribute to its corpuses' evolution. An additional section will discuss about a software implementation of these elements through a software prototype built using this ontology. On a longer scale, we are aiming at sharing this ontology with a broader spectrum of research units in various disciplines, debate on its relevance through experiments with industry and further develop it in a collaborative way. A discussion section will then highlight the assets, the limits and the perspectives of having a shared ontology for TRIZ future developments.

A Functional Analysis Approach for Product Reengineering
Charalampos Daniilidis, Katharina Eben, Udo Lindemann, Technische Universität München, Germany

Product reengineering is a very common practice in industry to improve and optimize product properties for new and individualized customer requirements and to meet internal requirements for less design and production costs. Products are thereby reengineered by applying new technologies and redesigning a number of product parts. The functional analysis applied by product reengineering is less abstract than by New Product Development and thus problems and weak points in a product structure can be easier identified. Disadvantage thereby is that the solution space for problem solving can be tremendously constrained through the detailed problem statements. In order to avoid this effect and to enhance innovative problem solving by product reengineering we introduce a functional analysis approach for problem modelling of existing product structures. We define a number of hierarchical levels for a product function structure in order to enable problem modelling on different abstraction levels. Thereby a large number of technologies and solution principles are included in the solution space. We use a pneumatic valve for rail systems as a case study in order to demonstrate the functional analysis and the problem modelling on different abstraction levels. Furthermore we clearly define terms such as technology, constructive layout, requirements, product properties and functions as well as their relations to each other, in order to enhance the use of this approach in the industry.

Innovative Design in Tensegrity Field
Simona-Mariana Crețu, University of Craiova, Romania

In nature, many systems function similarly to tensegrities, at all scale levels. The paper presents some applications of the method of creativity treated in [4], having the intention to reduce the types of structures of mechanical tensegrities to a finite number of models; so that we can simplify the design, in the same time maintaining a great variety of functions. The other purpose of this study is to obtain new tensegrity mechanisms that have the same structure and function in a similar way to natural systems.

12:40-14:00 **Lunch:** Lloyd Restaurant, Piata Victoriei 2

14:00-16:00 **Scientific session:**

Problem Solving for Multiple Product Variants
Katharina G.M. Eben, Charalampos Daniilidis, Udo Lindemann, Technische Universitaet Muenchen, Germany

Pneumatic control systems are built using various types of valves of which each single one is to meet specific constraints given by the environment a brake system is operated in. In the perspective of a manufacturer of pneumatic appliances this results in a high number of product variants, while each variant requires several product versions.

Complexity of product range inflicted by e.g. functional requirements might increase with the growth of a company, if the products of absorbed enterprises are retained and employed as a basis for new developments as well as the firm's original products. Thus the aim of the approach presented in this paper is the identification of highly similar or even redundant products and the design of

standardized components in order to facilitate the development process and to reduce current manufacturing costs. Thereby the approach should give the means to determine what has to be standardized and optimized in product architectures and how external and internal constraints should be taken into consideration.

By the use of functional modelling the products embodying physical solutions of identical function structures are recognized. Further the function structures of all product types are compared with the objective of discovering identical substructures. By the analysis of substructures, contradictory as well as consistent ones, standardized patterns and problem statements can be derived. Finally standardized designs can be defined for each problem statement to form a construction kit to be used over all product variants.

Principles of Technology Evolutions for Manufacturing Process Design
Andreas Roderburg, Fritz Klocke, RWTH Aachen University, Germany
Philip Koshy, McMaster University, Canada

Current research activities in the field of manufacturing technology development increasingly focus on integrated approaches for process performance enhancements. As in many process development activities, systematic design methodologies such as TRIZ are either not applied or even unknown in such instances. The main problem in such research efforts of finding integrated solutions is getting the relevant information or knowledge. This paper shows some important trends in the development of production systems in high wage countries and highlights important directions for manufacturing process improvements that are necessary for future innovations. The research reported herein is based on the systematic approach of a design methodology for the development of hybrid processes that was presented at the 2008 ETRIA TRIZ Future Conference. This general methodology still requires the knowledge of other technology domains in terms of standard solutions according to TRIZ.

Eco-design with TRIZ Laws of Evolution
Davide Russo, Daniele Regazzoni, Tiziano Montecchi, University of Bergamo, Italy

Sustainability is one the most recent theme designers have to deal with and sustainability parameters are quickly gaining the top of the list of the requirements any product has to fulfil. Due to standards, legal regulation and customer growing awareness of environmental issues, engineers cannot avoid turning their everyday activities from design to eco-design. By the way, a significant drop of environmental impact of products cannot be achieved by simply adding a ‘green’ constraint to the already overpopulated list of design constraints. To answer to this issue a plurality of methods are available helping the designer (or pretending to) to assess product lifecycle or to provide suggestions on how to innovate the product or process according to sustainable goals. Within this context, the present work describes a way of using TRIZ concepts and tools in order to both assess and innovate a technical system so that some practical activities to ensure sustainable results can be easily embodied into everyday design practice. The main novelty on the operative level consist of an original method based on a set of Guidelines derived from Laws of Technical System Evolution (LTSE) in order to assess the value of existing solution (e.g. using Resources and Functionality as a metric of evaluation), to understand the most promising directions of improvement and to improve said solution also according to sustainability requirements. The paper will show the way Guidelines are applied with practical examples and an industrial case study will be presented and discussed.

Quantifying and Formalizing Product Aspects through Patent Mining
Paul-Armand Verhaegen, Joris D’hondt, Joris Vertommen, Joost Duflou, Katholieke Universiteit Leuven, Belgium
Simon Dewulf, CREAX NV, Ieper, Belgium

Like most front-end design methodologies, TRIZ is characterized by the need of an abstraction level to apply the methodology. Users of these methodologies rely on intrinsic skills to map a specific situation to a abstracted one, analyze it through the methodology, and, if applicable, map it back to a specific situation. A methodology and algorithm are proposed that eliminate this subjective and difficult to perform mapping by formalizing automatically identified, fine-grained product dimensions or Aspects. These Aspects can be applied in idea generation and problem solving contexts, e.g. building a function database, performing trends analysis and searching for similar products.

16:00-16:20 Coffee break

16:20-18:00 Educational session:

Building New Bridges – TRIZ Tools for Approaching the Science Fiction Text
Cornelia Coşer, "Aurel Vlaicu" University Arad, Romania

The article sums up the results of a greater endeavour to apply to the science fiction text the basic principles of TRIZ and the ARIZ instruments enriched with the OTSM strategies for dealing with products of the imagination. They can all be used to critically approach the literary text, while Altshuller's own ventures in the domain of science fiction offer a good starting point for evaluating the quality of the fantastic ideas and revealing their sources. Thus, the method of analysis is in itself

an imaginative exploration and expands the mind preparing it for future confrontations just like the object of its study does.

Function Modeling Issues
Ives De Saeger, P41 Partners in Process Innovation, Belgium

The paper reviews function modeling and further investigates the Function/Attribute Analysis, according to the Subject-Verb-Object typology. Some difficulties in function modeling arise from time dependencies, subsystem definitions, choosing the verb and number of functions. An attempt is made to describe a more strict formulation of function modeling. An analogy with thermodynamics and systems theory is suggested resulting in new definitions such as function states and process functions, equilibrium of a system, dynamics of changes in a system and irreversibility of functions resolving the former mentioned conflicts. Several laws of evolution provide an additional help to complete the function model.

Applying TRIZ in Technical and Economic Higher Education
Nicolae Ionescu, Aurelian Vişan, Cristian Vasile Doicin, POLITEHNICA University of Bucharest, Romania
Daniela Hîncu, Academy of Economic Studies from Bucharest, Romania

The paper presents the author's attempt to deliver academic lectures and TRIZ method's presentations and adopting specific and comprehensive practical applications, for students in both technical and economic fields of higher education: in "Politehnica" University and the Academy of Economic Studies from Bucharest, as well. The main TRIZ tools are re-stated in the Romanian context, and they are aimed to be applied for innovative problem solving, in general, and for the product development, in particular. Some efforts were focused to provide a proper implementation of the TRIZ method for the specific industrial context of the Romanian economic stage.

Altshuller's Algorithm in Identifying New Solutions
Laurențiu Slătineanu, Margareta Coteață, Gheorghe Nagîț, Technical University "Gheorghe Asachi" of Iaşi, Romania
Alexei Toca, Technical University of Moldova, Chişinău, Republic of Moldova

In the Technical University "Gheorghe Asachi" of Iaşi - Romania, an university subject aiming to develop the students technical creative abilities, was introduced some decades ago. The applicative activities to this subject had to offer a general image about the process of identifying new ideas and solutions. With these aims in view, one of the laboratory activities was dedicated to the study of the possibilities to use the Altshuller's algorithm in identifying new technical or technological solutions. The paper presents some authors considerations about the using of the Altshuller's algorithm within the university didactic activities.

18:30-22:30 **Wine tasting tour - gala dinner:** Recas winery

3rd day (November 6th): Mechanical Engineering Faculty, Av. Mihai Viteazu 1 (150 Room)

08:30-09:00 **ETRIA Project feedback:**

World Wide status of TRIZ perceptions and uses: a survey results
Denis Cavallucci, INSA Graduate School of Science and Technology, Strasbourg, France

09:00-10:40 **Industrial & practitioner session:**

Open Innovation Mapping: Linking Companies and Domains through Automated Patent Analysis
Simon Dewulf, Vincent Theeten, CREAX NV, Belgium

TRIZ suggests a level of abstraction to make knowledge structured and accessible across domains. In this paper we apply this notion of abstraction to generate a map of open innovation opportunities across companies and domains. In today's networked economy, having a helicopter view across domains can bring efficiency and sustainability to the process of finding technologies. Our domain maps are aimed at companies and individuals that want to explore the possibilities for knowledge transfer between several companies. This paper proposes a method to discover the most important domains in which a company applies for patents, a method for extracting the most significant companies in a domain and a visualization method for easy user interaction. This process encompasses the selection and analysis of patents from a structured database to extract the most significant companies per domain and the most significant domains per company respectively. Our strategy involves the application of several data mining techniques such as clustering methods and fuzzy searching algorithms. Additionally, this paper also proposes visualization for depicting the results. We explore several cases in which we build the domain maps for several companies and explain strategies to use these maps to make the open innovation process more efficient.

Complex Model of Telescopic Cover
Jan Hudec, Petr Kolar
Czech Technical University in Prague, Czech Republic

The aim is to develop a fast development process with variable input to provide quality and cost efficient solution for high speed machines. Complex model of telescopic cover has been created as a tool to optimize this process. Trying to find a solution of a particular problem is not the right approach in this case, because it leads to discovery of much more complex problem.

The first step is to create a knowledge base of mechanical and material properties of separate items. This way it is possible to understand the nature of problems the item could be responsible for and to avoid them straight away. The second step is to solve interaction of these items in the assembly.

Elaboration of the Value Equation to Express Laws of System Evolution
Ido Lapidot, Intel Electronics, Israel

With the exception of Ideality, the Laws of system evolution are formed using words only. Mathematics as a universal language can serve better in expressing the laws and make them more understandable and usable. It is possible to partially achieve this by integrating two steps - dividing the equation to human related and non human related components and separating Supersystem from Systems components. The result is an elaborate equation which expresses more of the laws.

TRIZ Approach to Solve the Hot Rolling Process of the Seamless Steel Problem
Kyeongwon, Lee, Korea Polytechnic University & Korea Item Development Inc., Korea
Won-sik Kim, Doowon College, Korea

During hot rolling process of the seamless steels, they have to undergo the high temperature of about 1200 ^{o}C. The desired shape can be obtained through the high temperature process but it leads to the bad effect on the properties on steel. The oxidation of steel can occur over 800 ^{o}C. The related researchers have tried to solve this problem to find the optimum conditions. Their efforts somewhat improve the properties but cannot be the complete solution. Thus the TRIZ approach to solve this rolling process of steel plate problem completely was required. This specific situation can be converted into physical contradiction. “hot (1200 ^{o}C) and cold (< 800 ^{o}C).” We used “separation of space” principle and solved this problem.

An Eco-friendly Design of Electrical Discharge Machine (E-EDM) Using TRIZ Approach
V. S. Sreebalaji, Einstein College of Engineering, Tamilnadu, India
R. Saravanan, Bannari Institute of Technology, Tamilnadu, India
J. Srinivas, Indian Institute of Science, Bangalore, India

Electrical Discharge Machine (EDM) is one of the non-traditional machining processes. EDM process is based on thermoelectric energy between the work and an electrode. A pulse discharge occurs in a small gap between the work piece and the electrode and removes the unwanted material from the parent metal through melting and vaporization. The electrode and the work piece must have an electrical conductivity in order to generate the spark. Dielectric fluid acts as a spark conductor, concentrating the energy to a very narrow region. There are various types of products can be produced and finished using EDM such as Moulds, Dies, Parts of Aerodynamics, Automotives and Surgical components. This research work reveals how an Eco friendly EDM (E-EDM) can be modeled to replace die electric fluid and introducing ionized oxygen in to EDM to eliminate harmful effects generated while machining by using dielectric fluid and to make pollution free machining environment through a new design of E-EDM using TRIZ (a Russian acronym for Theory of Inventive Problem Solving) approach, since Eco friendly design is the need of the hour.

10:40-11:00 Coffee break

11:00-13:00 Closing session and ETRIA members meeting