

The 21st Japan TRIZ symposium 2025

Collection of Abstracts

2025.6.20

Symposium Organizing Committee

=====

EI01

(Keynote Lecture)

Redefining Inventive Design in the Age of AI: TRIZ Meets Foundation Models

Denis Cavallucci (Professor in Engineering of Innovation at INSA Strasbourg – France)

Artificial Intelligence has entered a transformative phase. With the advent of foundation models, generative AI, and context-aware reasoning engines, the boundaries of what machines can achieve are shifting from automation to co-creation. In the last three years, especially since the rise of Large Language Models (LLMs), the role of AI in R&D has moved far beyond data analytics or robotic automation. It now enters the realm of human creativity, design intent, and inventive thinking.

This keynote explores how the synergy between TRIZ, the theory of inventive problem-solving, and cutting-edge AI models reshapes the upstream phase of industrial R&D. We discuss how the capabilities of current AI tools—such as contextual semantic understanding, pattern detection in massive corpora of patents and scientific literature, and multimodal idea generation can deeply augment the cognitive phases of invention once considered exclusively human.

Since 2009, our research group has pioneered the integration of TRIZ into digital environments. Today, with tools like ChatGPT, Claude, and domain-specific LLMs, we demonstrate how intelligent agents can act as creative companions, supporting engineers in detecting technical contradictions, exploring abstract functions, and suggesting conceptual solutions across disciplinary boundaries.

This talk presents a vision for next-generation innovation processes, where AI does not replace human inventiveness but enhances and scales it. We will share new workflows that incorporate AI into TRIZ-based methods for:

- Deep information extraction from heterogeneous sources (patents, papers, reports),
- Contradiction mapping at system and subsystem levels,
- Interdisciplinary idea generation enhanced by cross-domain analogies, and

Our aim is to show how such AI+TRIZ synergy transforms R&D teams into augmented inventors, capable of tackling the accelerating complexity of today's innovation landscape.

Advanced technologies of perovskite solar cells and their social implementation

Tsutomu Miyasaka
Graduate School of Engineering, Toin University of Yokohama
E-mail: miyasaka@toin.ac.jp

Since our first discovery of perovskite solar cell (PSC) in 2006-2009, the rapid progress of its power conversion efficiency (PCE) is remarkable achieving the highest PCE of 27.0% that exceeds the top efficiency of single crystalline Si cell (26.1%). The current R&Ds of PSCs are focused on molecular engineering, using organic molecules, for defect passivation at heterojunction interfaces. This engineering enables improvement of photovoltaic performance and device durability.¹ We have been studying on the method of interfacial passivation with functional organic molecules, which enables high voltage output (close to theoretical limit) in photovoltaic performance (PCE>22%).² For practical applications, the stability of the devices still remains a major challenge. Use of organic cations in halide perovskites and diffusible dopants in hole transport materials (HTMs) are responsible for low stability at high temperatures (>120°C). To solve this, all-inorganic compositions of perovskite and use of dopant-free HTMs are highly desired. We used inorganic CsPbX₃ (X=I, Br) perovskites in combination of dopant-free HTMs. By molecular passivation at hetero-junction interfaces, CsPbI₂Br PSCs achieved PCEs of >17% under 1 sun and >34% under indoor LED illumination.³ With suitable passivation, the Cs-based cells work with high open-circuit voltage of 1.4 to 1.5V.⁴ For implementation of PCSs in society, lightweight modules are demanded. Thin plastic film-based PCSs are manufactured by low-temperature material preparation.⁵ Ink-jet coating process is applicable for fabrication of integrated high voltage modules. This topic will also be introduced in the lecture.

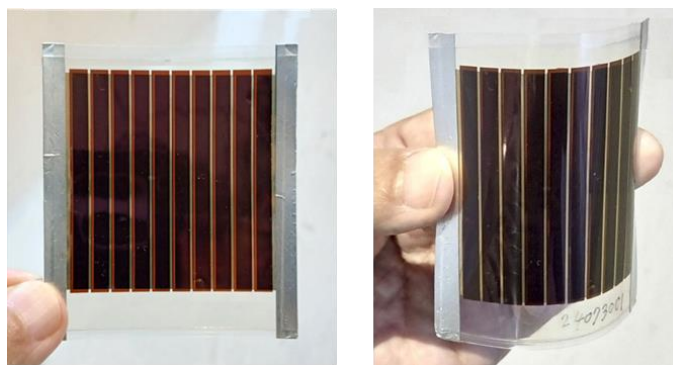


Fig. 1 ITO-PET film-based perovskite solar cell module (7×7 cm, output voltage 10V)

1. T. Miyasaka, editor, *Perovskite Photovoltaics and Optoelectronics —From Fundamentals to Advanced Applications—*, Wiley-VCH, Weinheim, 2021, ISBN: 978-3-527-34748-3.
2. G. M. Kim, H. Sato, Y. Ohkura, A. Ishii, and T. Miyasaka, *Adv. Energy Mat.* 2022, 12, 2102856.
3. Z. Guo, A. K. Jena, and T. Miyasaka, *ACS Energy Lett.* 2023, 8, 90-95.
4. Z. Guo, S. Zhao, N. Shibayama, A. K. Jena, I. Takei, and T. Miyasaka, *Adv. Funct. Mater.* 2022, 32, 2207554.
5. L. Yang, Q. Xiong, Y. Li, P. Gao, B. Xu, H. Lin, X. Li and T. Miyasaka, *J. Mater. Chem. A*, 2021, 9, 1574.

TRIZ Overview Seminar

Motoharu Miki (NPO Japan TRIZ Society)

Responding to customer needs and providing attractive products and services is the most important task for any company.

However, I think that there are many companies that are struggling to create hit products, and TRIZ holds the key to solving this problem.

In this seminar, we would like you to experience TRIZ through a simple workshop, focusing on the following representative methods of TRIZ, and realize its merits.

- Invention Principles: Utilizing the wisdom of a vast amount of patents, we derive ideas that solve technical problems.
- 9-Scene Method: Find a product concept by predicting the future product environment, needs, or seeds.

J01

Overcoming the “Resource Barrier” to TRIZ Implementation A New Outlook on Organizational Adoption and Everyday Practice of TRIZ through Collaboration with Generative AI Kiyoshi Shikakura (IDEA Inc., Japan)

TRIZ is a structured problem-solving approach designed to logically analyze technical challenges and generate innovative ideas from diverse perspectives, free from personal biases or past experience. However, its effective use requires a certain level of time and focus, making it difficult to implement and sustain in busy development environments. Recently, generative AI has begun to significantly reduce the burden of time-intensive tasks such as information gathering and analysis—key prerequisites for TRIZ application—lowering the practical barrier to implementation.

This presentation explores how generative AI can work in collaboration with TRIZ across the entire problem-solving process, including technology trend analysis, feasibility evaluation, and risk assessment. Use cases involving the domain-specific AI innovation intelligence platform “Patsnap Eureka” will also be introduced, illustrating a new model for integrating TRIZ into everyday R&D workflows.

J02

How to use TRIZ efficiently by controlling generative AI Takashi Ogata (IDEA Inc.)

Our function-based, objective-specific problem-solving program includes a problem-solving program using TRIZ and a program exploring the application of technology using the TRIZ System Operator.

In recent years, an increasing number of clients who receive consulting services are able to use generative AI such as ChatGPT. We are increasingly using generative AI in our consulting services.

At last year's TRIZ Symposium, we reported that TRIZ and generative AI can be used in conjunction with each other in the following two processes:

- 1) A process of intentionally changing the object O of function (S+V+O) to find new applications (an idea similar to the TRIZ science effect)
- 2) A process of using the TRIZ System Operator to grasp information and trends from the past, present, and future to extract future needs and issues.

In this report, we show that using the programming features of ChatGPTs to control the generative AI according to the user's needs is very important for making these TRIZ processes more efficient.

A New Paradigm in TRIZ Learning Introduction of AI Teaching Assistants to Support Individualized Learning

Naoki Oshima (Yamaguchi University).

This study proposes a new paradigm for Theory of Inventive Problem Solving (TRIZ) education optimized for individual learners by introducing an AI teaching assistant utilizing generative AI. In traditional TRIZ learning, standardized materials and uniform teaching methods make it difficult to flexibly accommodate the understanding levels and progress of individual learners. In this study, we utilized generative AI (ChatGPT) to create a comprehensive and detailed text-based learning guidebook covering the “40 TRIZ invention principles” and the “39 parameters of the TRIZ contradiction matrix.” This learning guidebook was registered as knowledge in NotebookLM, and an AI teaching assistant capable of providing individualized learning support was realized using the Retrieval-Augmented Generation (RAG) function.

The AI teaching assistant can instantly provide optimal information according to the learners' questions and level of understanding, enabling swift and accurate guidance for each learner's unique challenges and questions. The practical results of this study confirmed that utilizing an AI teaching assistant improves learners' understanding, promotes the acquisition of problem-solving skills, and enhances learning efficiency.

Furthermore, this study examined the changes in education brought about by the introduction of AI teaching assistants, particularly the significance of shifting the role of teachers from knowledge providers to learning facilitators.

This proposal aims to provide important insights into the effective use of AI in future educational settings by demonstrating a new approach to advancing and individualizing educational methods in TRIZ education.

DX of TRIZ Creative Problem-Solving Education Construction of an Individual Optimization Learning Platform Using AI Agents

Naoki Oshima (Yamaguchi University)

This study aimed to digitize TRIZ creative problem-solving training in companies and build and demonstrate an individual optimization learning platform centered on AI agents. The platform consists of three layers: (1) a chat-based learning app powered by ChatGPT (enabling learners to study the 40 principles and 39 parameters of TRIZ through exercise problems with automatic feedback); (2) a workflow-based AI agent that analyzes learners' question logs and progress to dynamically adjust learning paths; and (3) a three-layer structure that integrates course material management, communication, and visualization functions via MCP (Google Sheets/Power BI) and communication tools (Teams, Slack via Zapier). Google Sheets/Power BI for the integrated integration of content management, communication, and visualization functions via MCP integration. The training process consisted of four phases: preparation (setting corporate objectives and generating modules using AI), self-learning (dialogue-based learning and progress monitoring), workshop (exercises and visualization with AI assistance), and follow-up (recommendation of individual exercises and automatic reminders). Through examples of product development and process improvement, we aim to enhance participants' creative problem-solving and innovation capabilities, improve training efficiency, reduce instructor workload, conduct ROI analysis based on learning data, and establish a company-wide foundation for continuous talent development. This initiative seeks to demonstrate the usefulness and scalability of TRIZ training in corporate talent development strategies from both academic and practical perspectives.

Research on short-term/immediate prediction of earthquakes

Based on the ideas of TRIZ

Clarify the vision of the final goal and proceed with research and development

Toru Nakagawa (Osaka Gakuin University)

The Seismological Society of Japan (SSJ) and the government have stated that "Earthquake Prediction is impossible with current technology" because the Great Hanshin-Awaji Earthquake (1995) and the Great East Japan Earthquake (2011) were not foreseen or predicted. The decision was made to shift the focus from EQ Prediction to three key areas: EQ observation, fundamental research into EQ mechanisms, and the development of EQ disaster mitigation measures. In contrast, the most prominent entity in Japan continues to prioritize the predictability of EQs, aiming to minimize the associated damage to individuals and society.

Until recently, research into EQ prediction has been limited to preliminary studies in the field. Fortunately, we have observed some clear clues to EQ prediction methods in Japan over the past two to three years.

The first piece of clue is the Kamiyama method, which analyzes GEONET data on crustal movement to detect abnormal variations a few years to a few months before EQs. The second clue is the Tsutsui method, which involves observing the DC electric fields deep underground continuously to detect drastic fluctuations of signals from a few hours before to a few hours after EQs.

I began to conceptualize the development of a technical system for predicting EQs in real time, with the objective of significantly reducing EQ disasters. This initiative would be anchored by the aforementioned methods and would encompass the operation of official EQ Prediction warnings.

The final goal's vision, also known as the "Ideal Solution" in TRIZ, is outlined in the table below. A national agency will officially issue three stages of EQ Prediction Warnings before significant EQs.

	(A) EQ Prediction Notices	(B) EQ Prediction Warnings	(C) EQ Prediction Emergency Warnings
Timing of issue	1 year ~ 1 month in advance to the EQ	10 days ~ half a day in advance to the EQ	2 hours ~ 10 minutes in advance to the EQ
precursor	P1 is observed	P2 is observed	P3 is observed
Region, Size, Timing	Region X1, Size Y1, Timing T1 are estimated	Region X2, Size Y2, Timing T2 are estimated	Region X3, Size Y3, Timing T3 are estimated
judgment	Likely to occur	Very likely.to occur	Very high risk to occur
To relevant authorities	Prepare for warning in advance	Make preparatory measures for avoiding/reducing damages	Do emergency actions for reducing damages in the whole society

To the people.	Keep calm.	Prepare for evacuation and disaster prevention around you.	Promptly do damage reducing actions and evacuate to keep safe,
Attention in the future	Beware of possible EQ Prediction Warnings	Watch for possible emergency warnings at any time day or night..	When an earthquake occurs, an Earthquake Early Warning is issued.

The Kamiyama method may be used to issue (A) EQ Prediction Notices. The system's current limitations include reduced sensitivity to EQs occurring in the ocean or deep underground on land. Additionally, the timing of EQs remains difficult to predict.

The Tsutsui method shows great promise in the area of (C) EQ Prediction Emergency Warning. It can detect precursor signals several hours to half an hour in advance and with high sensitivity for far-away EQs on land or under the ocean. The primary challenge is the significant expense associated with installing the instrument at a considerable depth underground at a remote location to minimize noise. In order to estimate the EQ location, it may be necessary to obtain additional observation data. According to Heki and Umeno's methods, the observation of electrical anomalies in the ionosphere using satellites may support the issuance of an emergency warning.

However, at this time, no indications have been found regarding the methods for issuing (B) EQ Prediction Warnings. The warnings, to be issued 10 days to half a day in advance, are expected to be most useful for people and society as they prepare for disaster prevention and evacuation.

To achieve the objective of EQ Prediction Warnings (A)(B)(C), it is necessary to conduct extensive and large-scale R&D on technological systems. I hereby propose that the Earthquake Prediction Society of Japan (EPSJ) establish a Research Foundation to operate a collaborative research project. We are committed to making significant and sustained efforts to achieve the following:

- Gaining the understanding of the Seismological Society (SSJ), academia, the media, the government, and the general public.
- Making EQ prediction capabilities finally possible and useful for reducing EQ disasters.

J06

On constructing viewpoints for the natural world operator database under construction and modeling problems

– From the efforts of the Intellectual Property Creation Research Subcommittee –

Narumi Nagase (Japan TRIZ Society Intellectual Property Creation Research Subcommittee)

The Intellectual Property Creation Subcommittee has proposed and is working on building a database (idea database) consisting of a concept dictionary and attributes of the natural world as a collection of hints for generating ideas that can be applied to a wide range of fields.

With knowledge of the natural world as the basis for generating ideas, we aim to utilize it more creatively and systematically, and we are currently working on updating the structure to incorporate elements of the equivalent transformation theory and the attributes of TRIZ.

Additionally, in order to further utilize the database in the future, we are also examining functional elements that can act as an entry point for searches in order to improve convenience for users.

In this presentation, we will focus on VI as a problem-solving perspective and goal, and introduce proposals for its standardization and structuring, as well as the results of our analysis of the current manifestation status of VI items.

In addition, from the process of this study, I have gained some insight into a specific method that can lead to an understanding of TRIZ problem modeling, which I would like to propose.

J07

Proposal for a smart thinking method using idea database

Kimihiko Hasegawa, Nagase Narumi, Hirotugu Ishihara,

Toshiaki Masaki, Yasunori Nakao, Taiki Ikegaya

(Japan TRIZ Association Intellectual Property Creation Research Subcommittee)

TRIZ is a huge system, so it has been said that it is difficult for beginners to use it practically. On the other hand, in today's world where elderly people with a lot of practical experience are retiring from the front line, it is an urgent issue for those in charge of promoting TRIZ to think of ways to popularize TRIZ in Japan, where the birthrate is declining and the population is aging.

To make TRIZ itself easier to use, it may be possible to provide tools available on the Internet so that TRIZ can be used anytime, anywhere.

Also, it needs to be easy to use so that it can be operated intuitively.

In order to utilize elderly people with a lot of experience in TRIZ and to solve difficult problems in an easy way, it is necessary to apply the opposing concepts of the direct approach and the inverse approach.

We also show that four strategies (division by time, space, whole and part, and conditions) are effective in coming up with multiple ideas to solve difficult problems regardless of the field of application.

J8

Practical application of PBL-type lessons using generative AI in the TRIZ framework

Takatoshi Ohtsu, Yuko Fujie, Fumi Satoh, Hinaki Baba (NIT NUMAZU College)

Numazu National College of Technology places emphasis on intellectual property education from the perspective of developing local industries and cultivating human resources who will lead Society 5.0, and promotes university-wide intellectual property learning. The college has established a "spiral-up university-wide intellectual property learning system" in which students from first-year students to those in the specialized course are continuously exposed to "intellectual property" according to their stage of development at least once a year.

Since 2017, interest in "learning intellectual property and the idea generation method TRIZ" has increased among students in the lower grades through the "Engineering Basics II Intellectual Property Seminar for all first-year students," "Intellectual Property Basics Seminar for all second-year students by the Japan Patent Attorneys Association," "Intellectual Property Application Seminar for all third-year students," "Credit-based Intellectual Property Management Skills Examination," and intellectual property learning in "Problem Research."

In the upper grades, a PBL-style class called "Society and Engineering" is a compulsory subject for all fourth-year students. The curriculum involves analyzing the situations of local governments and companies, and using the "TRIZ" thinking method to "propose solutions that are conscious of practical application" for the problems identified there.

Starting in fiscal year 2024, generative AI will be used in the nine-screen method, IF_QCD_SEC analysis, and the framework of 40 invention principles.

As a result, we were able to discover problems from multiple perspectives, and furthermore, we were able to propose feasible ideas and deepen our understanding of the TRIZ inventive principles.

J9

Writing an English research paper based on the essence

Kiyohisa Nishiyama (Idea Studio Co., Ltd.)

In this presentation, I will introduce an "essence-first English paper writing method" that I developed by applying the TRIZ idea generation method.

I first became interested in TRIZ in search of applications for research topic creation, but after experiencing difficulties connecting it to academic research, I reconsidered the essence of the problem and reconstructed the theory in the form of support for writing English papers. In this presentation, I will describe the transition of my thinking and my application practice.

Research into the general application of "evolutionary trends"
New business models created by untapped resources and potential needs
using "substance-field analysis" and generative AI~

Business and Management TRIZ Research Section
 (NPO Japan TRIZ Society)

Satoshi Ikeda, Hisataka Izawa, Mamoru Ohasi, Yasuo Moriya, Ikuo Yoshizawa

This study group aims to conduct research and develop guidance for utilizing TRIZ, including application methods and case studies, to solve problems in the fields of business, administration and management, with the aim of contributing to the dissemination and development of TRIZ.

1. Since TRIZ-style analysis tools (Contradiction Matrix and Inventive Principles for Management Systems, Evolutionary Trends and Evolutionary Levels, etc.) are now more or less ready, previous TRIZ Symposia have focused on the subsystems of business models and examined how to apply the "Evolutionary Trends" proposed by Darrell L. Mann, centering on the Action Matrix and Strategy Canvas of the Blue Ocean Strategy.

In 2021, we focused on "evolutionary trends" to explore future trends of specific businesses and identify new functions (success factors and competitive factors) that must be met in the future. We focused on business risks as a factor that accelerated the evolution of business models due to the COVID-19 pandemic, and presented a method to explore risk factors in the business environment through inverse thinking.

In 2022, we discussed a case study in which new business models were created by adding or deleting identified subsystems (evolutionary trends) and raising or lowering the evolutionary level by using the SDGs (Sustainable Development Goals) as the basis for exploring future trends in a specific business.

2. Therefore, from this fiscal year onwards, we will use the SDGs framework as a future outlook, position the subsystems that make up a business as nine building blocks, which are the elements of the Business Model Canvas, identify evolutionary trends that should correspond to the four actions of the action matrix that depicts the Blue Ocean Strategy's strategic canvas - "add," "increase," "reduce," and "remove" - and conduct case studies based on these.

Furthermore, by creating new businesses both within and outside the industry captured in the "Business Model Canvas," we will study how to build new business models aimed at solving social issues within the framework of the SDGs as a future outlook, and conduct case studies on these methods.

3. We plan to continue these research projects, with a particular focus on how to apply the "evolutionary trends" proposed by Darrell L. Mann and the TRIZ methodology as methodologies for creating new business models by creating new business models from existing business models both within and outside the industry, and how to clarify them as business models by incorporating them into the framework of the "Business Model Canvas."

The core of future research will be the methodology for selecting and applying the "evolution

trends" that correspond to the four actions in the action matrix to further evolve the nine building blocks, which are the elements of the "Business Model Canvas" that make up the subsystems of the clarified new business model.

4. As part of last year's efforts, the following items were considered.

We will conduct case analysis of business models that have been created to solve social issues within the framework of SDGs as a future outlook by generating unused resources both within and outside the industry.

5. This year, as a continuation of last year, we will conduct case studies on the use of AI (ChatGPT and Copilot) to discover unused resources and potential needs that have contradictions across industries, and to create new business models that combine and create new business models.

J11

TRIZ-Rx Subcommittee Activity Report No. 6

Status of construction of database of previously published information from symposiums

Narumi Nagase, Yuhji Mihara, Kimihiko Hasegawa, Satoshi Ikeda, Yasunori Nakao
(Japan TRIZ Society TRIZ-Rx Subcommittee)

The TRIZ-Rx Subcommittee has been active since 2018 with the objective of "organizing the contents presented at past symposiums and considering smarter ways of utilizing them. Systematically organizing them from several perspectives, and using them to advance the development of TRIZ."

By last year, we had made some progress in constructing the database that we had envisaged when the subcommittee was established, and we had also constructed a compact, fully searchable version, and have reported on its demonstration operation.

In this presentation, we will report on the results of an analysis of the database contents, including the most recent update information, and hope to provide an opportunity for the participants to once again take a look at the database, as well as to exchange ideas on how to make effective use of the database in the future.