European Journal of Technical and Natural Sciences 2026, No 4
ISSN 2414-2352

PREMIER Publishing
ppublishing.org

DOI:10.29013/EJTNS-26-4-52-58

MODERN DIGITAL TECHNOLOGIES IN THEIR INTERACTION WITH TRIZ (Modern Digital Technologies with Elements of Artificial Intelligence and Artificial Neural Networks in Their Interaction with TRIZ and ARIZ)

Oleksii Hrachov [1]

[1] DevSecOps engineer, Odessa, Ukraine

Cite: *Hrachov O. (2026). Modern Digital Technologies in Their Interaction With Triz. (Modern Digital Technologies with Elements of Artificial Intelligence and Artificial Neural Networks in Their Interaction with TRIZ and ARIZ). European Journal of Technical and Natural Sciences 2026, No 4.* https://doi.org/10.29013/EJTNS-26-4-52-58

Abstract

This article examines the application of modern intelligent multidisciplinary digital technologies incorporating elements of artificial intelligence and artificial neural networks in the development of innovative engineering solutions based on the principles of TRIZ and ARIZ. Particular attention is devoted to the analysis of the psychological, technological, and marketing factors that influence the transformation of inventive concepts into commercially viable products under conditions of rapidly evolving digital technologies. The article substantiates the necessity of adopting a fundamentally new multidisciplinary approach to engineering design in response to the shortening innovation cycle, increasing product complexity, and rising costs of prototype development and testing. The proposed concept integrates systematic inventive problem-solving methodologies with intelligent digital technologies to identify non-obvious auxiliary innovative functions capable of improving product competitiveness and commercial potential. It is concluded that only the comprehensive integration of TRIZ/ARIZ methodologies with artificial intelligence, artificial neural networks, and multidisciplinary digital technologies can significantly enhance the efficiency of innovation processes and increase the probability of successful commercialization of advanced technical solutions.

Keywords: *Digital Technologies; TRIZ; ARIZ; Intelligent Multidisciplinary Digital Technologies; Product Marketing Aspects; Simulation of Used Structural Materials; Innovation Analysis; Paradoxes of Dynamic Fuel Component Mixing; Stereotypes and Associated Psychological Barriers*

Introduction

All inventors know that sometimes technical solutions are created that, under real-world conditions, function effectively and solve multiple problems – problems that, even at the conceptual stage, prompted the inventor to conduct innovative analysis and triggered purposeful creative activity. At the same time, there are contrived and seemingly obvious technical solutions that are developed in isolation from reality and solve absolutely nothing, except for serving as a means of pursuing ambitious claims to some kind of (usually useless) idea in the field of technology and engineering.

Figure 1. *An example of modern innovative design with full simulation of the used structural materials and their properties and performance characteristics, including the type of mechanical processing and finish type*

Moreover, technical solutions that arise within a specific local domain inevitably affect, either directly or indirectly, established technical stereotypes and the psychological barriers that have emerged, and continue to emerge, based on these stereotypes. These barriers often obstruct the resolution of technical and technological contradictions that evolved from these psychological foundations.

Twenty years ago, the necessity for the second group of inventions – and the equally important need to consider the influence of psychological barriers – was often justified by their auxiliary role: serving as a basis for selectively identifying the most effective and non-obvious technical solutions from the total pool of initiated technical and creatively combined ideas.

In modern designs and technological solutions, novelty is no longer a reflection of a single technical discipline, but rather the result of a combination of integrated disciplines, including electronics, microelectronics, advanced materials science, fiber optics, and laser technology. This necessitates an evaluation of obviousness or non-obviousness from multiple perspectives – an assessment that can only be adequately performed by narrow-domain experts working in collaboration with specialists in complex systems integration.

Figure 2. *An example of modern innovative design utilizing sectional views, along with a technical and innovative analysis of the level and credibility of the qualification of non-obviousness for all components of the device, as well as the same level of non-obviousness in the functional characteristics of assembly associations and the resulting commercial advantages of these characteristics*

Over time, each technical discipline develops a set of typical solutions that gradually become entrenched as stereotypes, familiar to nearly all practicing professionals in the field.

Such stereotypes become embedded in everyday practice, and any changes in design or technology tend to encounter certain barriers, which, over time, evolve into well-formed technogenic psychological barriers. In this context, effective participation in the synthesis of innovative ideas – especially through brainstorming – and the refinement of those ideas and their innovative combinations toward the boundary of the Ideal Final Result may encounter, and often do encounter, stereotypical psychological barriers. Even when part of a group generates technically viable proposals that are non-obvious to the average specialist in that specific field, such ideas are unlikely to be immediately and unequivocally accepted. They are often rejected, particularly at the early stages of development.

Figure 3. *The figure shows a view of a diesel generator being modernized by integrating a device into its fuel system for mixing and homogenizing the fuel mixture – diesel fuel with methanol*

The process of developing a project for integrating a device for dynamic fuel component mixing into the fuel supply systems of thermal equipment (including boilers of all types)

Figure 4. *The figure shows a device for online mixing and homogenizing fuel mixtures before injection into the combustion chamber of a thermodynamic system*

Figure 5. *The figure also shows a device for online mixing and homogenizing fuel mixtures before injection into the combustion chamber of a thermodynamic system, including internal components*

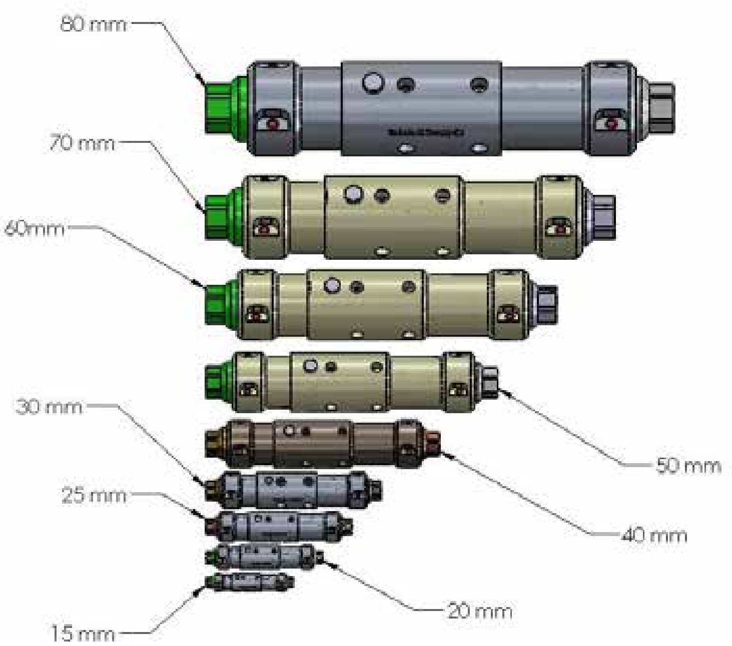

Figure 5. The figure shows a range of sizes for devices used for online mixing and homogenizing fuel mixtures before injection into the combustion chamber of a thermodynamic system.

All 9 sizes of devices for online mixing and homogenizing fuel mixtures before injection into the combustion chamber of a thermodynamic system have an equivalent internal structure and a uniform design of internal components.

Figure 6. *The figure shows devices for monitoring the parameters of the obtained fuel mixture*

For boilers, the device must include a nozzle to ensure a higher level of adaptation to the fuel supply systems for the combustion chamber or burner. The development of the nozzle is one of the components of the project.

At the same time, the device itself can be presented as a standalone product or a compact burner.

This applies equally to boilers that use diesel fuel and to those that use natural gas as fuel.

All variants and working versions of the device and the technology for its application can be developed simultaneously and in parallel.

For devices designed for dynamic mixing of fuel components, where liquid fuel plays a dominant role, there are several paradoxes inherent in all such applications. The first paradox is characterized by the fact that in the pipeline, with the same cross-section, the same initial pressure, and the same initial flow rate of the incompressible liquid component, a ring-shaped vacuum zone is formed without any additional energy consumption.

Figure 7. *The figure shows the appearance of the fuel mixture after structure restoration*

Figure 7–1. *The figure shows the internal structure of the device*

Figure 8. *The figure shows the appearance of the fuel mixture before structure restoration*

This zone represents a kind of boundary between the incompressible liquid and the compressible mixture of this liquid with gas, in this case, air.

The second paradox is that within the same pipeline, the liquid entering the pipeline changes its physical properties from an incompressible working fluid to a compressible working fluid.

Figure 9. *The figure shows systems using artificial intelligence and artificial neural networks applied during the qualification testing of the technology and device*

The third paradox is that at the point of change in the physical properties of the flow, the flows of the liquid and gaseous components are coaxial, with the liquid component flow enveloping the gaseous component flow.

Figure 10. *The figure also shows systems using artificial intelligence and artificial neural networks applied during the qualification testing of the technology and device*

The directions of flow at the indicated point coincide.

The fourth paradox is that in the zone, which represents the boundary between the incompressible part of the flow and the compressible part, there is a deep vacuum or rarefaction. This occurs under conditions where two coaxial flows each create a ring-shaped rarefaction zone: one created by the incompressible liquid flow, and the other created by the compressible air flow.

Both of these zones are coaxial to each other, and the thickness of the flow in them does not exceed 100 micrometers for the liquid and 25 micrometers for the gas.

The linear velocity in each of the flows in the rarefaction zone exceeds 100 meters per second, with no additional energy sources being used in the process.

The fifth paradox is that the flow of the mixture accumulates the kinetic energy of the flows of all components, and the kinetic energy of the mixture exiting the device exceeds the kinetic energy of the liquid component entering the device.

The sixth paradox is that under conditions of deep rarefaction and high linear velocity of the flows, in the boundary zone separating the incompressible liquid and the compressible mixture, numerous capsules of composite fuel are formed. More than 27 million spherical capsules, each with a diameter not exceeding 50 micrometers, are present per liter of mixture or fuel composite.

Figure 11. *The figure also shows fragments of the system using artificial intelligence and artificial neural networks applied during the qualification testing of the technology and device*

In these capsules, the core is a compressible element – air – and the shell is an incompressible element – liquid or a homogeneous mixture of liquids.

The seventh paradox is that when necessary, a liquid additional component of the fuel composite, such as water, can be drawn into the boundary zone between the compressible and incompressible parts of the flow.

At the same time, no additional energy is required to draw water into the liquid fuel component flow and mix it; only the energy of the liquid fuel component flow is needed.

References

Ackerman. *Water Harvester and Purification System*. United States Patent No. 10,071,918. September 11, 2018.

Catherwood, Sr. *Dehydrating Air-Filtering Apparatus*. United States Patent No. 4,594,082. June 10, 1986.

Rolandson. *Exhaust Gas Recirculation Compressor Inlet Thermal Separation System*. United States Patent No. 10,767,659. September 8, 2020.

Hedlund. *Self-Contained Photovoltaic Distillation Apparatus*. United States Patent No. 10,759,677. September 1, 2020.

Kow. *Humid Air Stream Generator*. United States Patent No. 10,731,880. August 4, 2020.

Stuckenberg. *Atmospheric Water Generation Systems and Methods*. United States Patent No. 10,583,389. March 10, 2020.

Panda et al. *Economically Viable Atmospheric Water Generator*. United States Patent No. 10,718,101. July 21, 2020.

Bravo et al. *Modular Apparatus for Water Production*. United States Patent No. 10,422,112. September 24, 2019.

Bravo et al. *Water Production Apparatus for Rigorous Climates*. United States Patent No. 10,385,549. August 20, 2019.

Hering et al. *Advanced Laminar Flow Water Condensation Technology for Ultrafine Particles*. United States Patent No. 9,821,263. November 21, 2017.

Shinoda et al. *Indoor Unit of Air-Conditioning Apparatus*. United States Patent No. 9,976,769. May 22, 2018.

submitted 08.07.2026;
accepted for publication 22.07.2026;
published 31.07.2026

Contact: dariabooksclub@gmail.com