



Keynote Speech

Automating ARIZ with Large Language Models: Toward AI-Assisted Inventive Problem Solving

Speaker Name,

Prof. Denis CAVALLUCCI, Professor in Engineering of Innovation at INSA
Strasbourg – France



Speaker Biography: Denis Cavallucci is a Full Professor at INSA Strasbourg and a leading expert in TRIZ and AI-assisted innovation. For over 30 years, he has transformed systematic innovation into an engineering discipline combining TRIZ, AI, and large-scale knowledge analysis. His work bridges academia and industry through publications, patents, software systems, and collaborations with major industrial partners in defense, manufacturing, and consumer products.

Abstract: Recent advances in Large Language Models (LLMs) are profoundly transforming how inventive problem solving can be supported in industrial R&D. While TRIZ has long provided a rigorous framework for addressing technical contradictions, its most advanced algorithm - ARIZ-85C - remains difficult to deploy in practice due to its complexity, required expertise, and time-consuming execution. This keynote presents recent research from the AIARD (Artificial Intelligence Assisted R&D) at INSA Strasbourg on the automation of ARIZ using artificial intelligence. It originates from research activities carried out in the framework of the AIARD PhD program, particularly with Iliass Ayaou and Dr. Hicham Chibane under the supervision of Prof. Denis Cavallucci.

The work explores how LLMs can operationalize the complete ARIZ-85C process by combining structured inventive reasoning with patent-based contextual grounding.

The presentation introduces a novel AI-assisted workflow integrating:

- automated patent-context extraction,
- contradiction formulation,
- resource and IFR analysis,
- guided execution of ARIZ substeps,
- novelty assessment against prior art,
- and AI-supported synthesis of inventive concepts.

The proposed framework supports all nine parts of ARIZ-85C while allowing selective execution strategies to balance creativity, interpretability, computational cost, and industrial usability. The keynote will also discuss how patent retrieval systems and semantic embeddings can stabilize reasoning processes and reduce hallucinations in generative AI systems.

Experimental results demonstrate that explicit ARIZ guidance combined with contextual patent grounding significantly improves the novelty and inventiveness of generated solution concepts compared to baseline prompting strategies. Industrial case studies illustrate how AI-assisted ARIZ can support interdisciplinary knowledge transfer and accelerate upstream innovation activities.

Beyond technical demonstrations, this talk addresses a broader question: can AI become a true cognitive partner for inventive engineering rather than merely a text-generation tool? The presentation concludes with perspectives on the future of AI-assisted systematic innovation, including human-in-the-loop creativity, explainable inventive reasoning, and autonomous innovation agents.