FORMALIS

seamless systems engineering

Key points:

AI-POWERED
REQUIREMENTS FORMALIZATION

USER-FRIENDLY
INTERACTION

DETERMINISTIC
KNOWLEDGE GRAPH

CREDIBLE,
EXPLAINABLE AUTOMATION

FORMALIS – AI for Formalized Requirements and Verified Knowledge Modeling Transforming requirements engineering through automation, structure, and explainability

FORMALIS is an advanced AI framework designed to formalize requirements, structure domain-specific knowledge, and generate development artifacts, automatically & reliably, in human- and machine-readable formats. It creates a seamless bridge between natural-language input and formal, verifiable outputs that power modern engineering toolchains.

At its core, FORMALIS uses state-of-the-art large language models (LLMs) such as GPT-4, LLaMA3, and Gemini Pro to analyze and rewrite informal requirements into formally structured, semantically precise templates. These templates serve as the foundation for building navigable, scalable knowledge graphs, capturing domain-specific information in a format that is both human-interpretable and machine-verifiable.

FORMALIS enables automated generation of test specifications, implementation templates, and traceable development artifacts. This approach not only boosts efficiency but also ensures deterministic and reliable outputs. Engineers gain confidence in the process through KPIs such as semantic similarity, logical consistency, and inconsistency count, quantitative metrics that make explainability and transparency measurable.

Built on the principles of “Credible AI,” FORMALIS® prioritizes traceability and formal methods. It integrates seamlessly into existing Model-Based Systems Engineering (MBSE) environments and toolchains, including SysML, codeBeamer, Jupyter notebooks, and IBM tools. With a scalable, cloud-ready architecture, it supports both formalization-on-demand and embedded real-time workflows.

FORMALIS also includes an intuitive Copilot interface that allows users to visualize, navigate, and interact with formalized requirements and knowledge graphs. From generating causal chains to simulation models, FORMALIS empowers requirements engineers to achieve structured, verifiable, and explainable outcomes **on the fly**.

Formal Requirements. Verified Knowledge. Automated.

The knowledge graph contains domain-specific knowledge

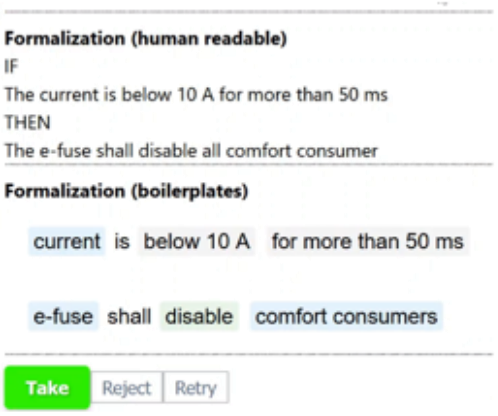
Boilerplates for requirements formalization

Example of an automatically generated test-specification

Original requirement			
LVPN-12345: „The minimum voltage at the battery must not fall below 11,3 V. For safety reasons, this must be ensured 1) when outside temperature is below 0°C and the battery charge level is low, or 2) during evasive maneuvers."			
Conditions:			Statement:
Outside temperature is less than 0 °C	Charge of battery is in the state low	Evasive maneuver is active	Voltage of battery shall be at least 11,3 V.
True	True	True	True
True	True	False	True
True	False	True	True
True	False	False	True/False
False	True	True	True
False	True	False	True/False
False	False	True	True
False	False	False	True/False

Visualization and interaction with formalized requirements through a copilot frontend

LLMs (e.g. GPT-4o)*
Cloud
Formal Methods



KEY ADVANTAGES

Automated formalization of natural language requirements using LLMs

Creation of machine-readable knowledge graphs with domain-specific logic

Generation of deterministic test specifications and system models

Explainable AI with transparent KPIs for quality, consistency, and traceability

Seamless integration with MBSE and requirements engineering toolchains

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