

SIMULATION AND AI

Andrei Borshchev¹

¹The AnyLogic Company, Chicago, IL, USA

ABSTRACT

This presentation aims to provide guidance on navigating the technology stack of digital transformation — with a focus on the complex, multifaceted relationship between Simulation and AI. We'll discuss three key topics: 1) Why hasn't simulation, as a training environment for machine learning, taken off at scale? 2) Can AI (and LLMs in particular) replace simulation? 3) How does AI affect the simulation model lifecycle, and how can it assist the modeler? We will also touch on the evolving requirements today's industry places on simulation technologies.

1 THE TECHNOLOGY STACK OF DIGITAL TRANSFORMATION

Navigating the technology stack of a modern enterprise is challenging. IoT, Digital Twins, Big Data, Agentic AI, Synthetic Data, LLMs, VR, Simulation, Industrial AI – terms keep piling up at a pace that might have made William of Ockham very unhappy. In this session, we will try to connect some of the dots and spotlight where Simulation fits into the bigger picture.

2 PRE-LLM ERA: SIMULATION+ML “FALSE START”

About 6-10 years ago we thought: well, if AI can beat a human at chess or go, why can't it run a factory floor, manage a supply chain, control road traffic? Back then, there were no LLMs, so AI mostly meant ML, usually neural networks trained to perform certain specific tasks. And simulation was supposed to play a key role: where else would you safely train and test learning agents if not in a risk-free, realistic virtual environments that simulation models provide? A lot of investments were made in this direction. Were there success stories? Yes. Did it take off at scale? No. We will explore why.

3 IS AI A REPLACEMENT FOR SIMULATION?

Can “pure AI” replace a calculator? No, it can't. When an LLM solves a math problem, it's not doing the math itself – it uses a calculator “in the backyard” in the form of, e.g., writing and executing a Python program. Can AI take a manufacturing facility layout and processes specifications and locate a bottleneck? No. Because to date AI does not have simulation engines “in the backyard” and, what is more important, ability to build and validate simulation models. Simulation and AI are built for different kinds of problems. AI (a very smart black box) is great at recognizing patterns and makes predictions based on similar, known examples. Simulation (a white box) takes the system's state and behavior as input and generates possible future scenarios – including those never seen before. Simulation is transparent, it shows how the scenarios unfold and explains why.

4 HOW CAN AI HELP SIMULATION?

This is another aspect of the Simulation–AI interaction: how does AI affect the simulation model lifecycle, how can it assist the modeler? Can AI help with model conceptualization? This is an area of active research – we will review some recent progress. Can AI assist in writing code for data-rich business logic within a model? Absolutely – this is already happening at scale. Can it perform model validation? Probably not

much, as this typically requires deep domain knowledge from an SME. What about analyzing and interpreting simulation output? Here, AI has already shown potential to outperform humans. This section will be in the form of small open discussion.

5 TODAY'S INDUSTRY REQUIREMENTS FOR SIMULATION

The growing operational use of simulation and its deeper integration into business workflows have transformed the requirements for software supporting simulation modeling. Traditional standalone desktop tools worked well for one-off, project-based use (“build and dispose”) but they fall short in meeting the industry needs today. To remain relevant in the modern tech stack, we must provide a *simulation ecosystem* including cloud-based collaborative model development, simulation deployment, data and AI integration, scalable execution, and full lifecycle management.

REFERENCES

AI and Simulation: What Executives Need to Know. 2025. AnyLogic and the Engineering Group webinar recording. <https://www.youtube.com/watch?v=NJLX2L2wkAg>, accessed 12 October 2025.