

MODELING OF PRODUCTION PROCESSES

В. А. НЕДЮХИН

Научный руководитель В. А. ШИРОЧЕНКО, канд. техн. наук, доц.

Консультант Е. Н. МЕЛЬНИКОВА

Белорусско-Российский университет

Могилев, Беларусь

Simulation modeling has emerged as a powerful tool for analyzing and optimizing production processes in various industries. By creating digital replicas of real-world systems, simulation allows researchers and practitioners to study complex interactions, predict outcomes, and test scenarios without disrupting actual operations.

The increasing complexity of modern production systems requires innovative approaches to manage resources, optimize workflows, and ensure high-quality outputs. Traditional analytical methods are not efficient enough when dealing with dynamic, stochastic, and interdependent processes.

Simulation modeling offers a solution, which helps create virtual environments where production systems can be tested under varying conditions.

Simulation modeling involves the development of mathematical and computational representations of real-world systems. These models mimic the behavior of physical systems, allowing users to experiment with different configurations and parameters.

Key principles of simulation modeling are as follows: stochastic elements, dynamic behavior, system representation, validation and verification.

Simulation modeling has been widely adopted across industries to address a variety of challenges. Some notable applications include capacity planning, which is used to determine optimal resource allocation, identify bottlenecks, and assess the impact of capacity expansion, as well as supply chain optimization, workforce scheduling, quality control, sustainability initiatives.

Despite its benefits, simulation modeling faces a number of challenges that limit its widespread adoption: data availability and quality, computational complexity, model validation, cost and expertise, integration with existing systems.

Addressing these challenges requires collaboration between academia, industry, and technology providers. Standardization of methodologies, development of user-friendly software and training programs can help overcome barriers to adoption.

Simulation modeling is a cornerstone of modern production process analysis and optimization. Its ability to replicate real-world systems and explore “what-if” scenarios makes it indispensable for decision-makers seeking to improve efficiency, reduce costs and achieve sustainability goals. While challenges remain, ongoing advancements in technology and methodology promise to unlock new possibilities for simulation modeling. By embracing this transformative tool, industries can navigate the complexities of today’s global economy and pave the way for a more resilient and innovative future.