Call for Papers

Special Issue on "Integration of Operations Research with Digital Twins and AI"

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The International Transactions in Operational Research (ITOR), the flagship journal published by the International Federation of Operational Research Societies, will publish a special issue dedicated to *Integration of Operations Research with Digital Twins and AI.*

Digital twins (DT) and artificial intelligence (AI) are transforming Operations Research (OR). OR methods depend on collection, processing, reasoning, and integration of data. While some of these tasks still require human expertise, many have become automated or can be managed by AI, such as data-driven and language-based model development. Historically, limitations in data availability and certainty led to the creation of OR methods based on probabilistic predictions. With DT and AI, these constraints are eased, prompting critical questions about the continued relevance and effectiveness of traditional optimization and simulation techniques for modern, AI-driven operations and supply chains. At the same time, the integration of OR with agentic AI ecosystems is opening new opportunities, which this special issue seeks to explore, together with potential challenges.

Digital twins and AI fundamentally redefine what constitutes a "model." Models can become dynamic, able to reconfigure their structure and functionality in response to data, AI-driven insights, and collaboration between humans and AI. This shift moves the focus from purely algorithmic engineering to creative engagement with AI assistants, evaluating agent interactions, validating optimization suggestions, and testing scenarios using real-time or frequently updated data under various uncertainties. Instead of optimizing isolated models, agentic AI and digital twins enable coordinated decision systems built on human-AI collaboration.

Integrating with digital twins and AI is essential for OR to remain relevant in data- and AI-centric landscape. Traditional optimization methods often overlook the needs of end users, who face complex, unstructured problems with multiple objectives and uncertainties. Users expect a flexible environment that enables real-time exploration of alternatives, scenarios, and uncertainties, and that allows them to adjust inputs and assumptions as needed. Stand-alone, offline models cannot deliver these real-time insights unless connected to external data sources and digital ecosystems.

OR models must use up-to-date, real-world data to remain practical. Creativity and adaptability are crucial as decision-support models evolve in fast-paced settings. Many OR models lack the capacity to learn and improve as data and environments change. Beyond adjusting parameters, structural changes—like adding constraints—may be needed to keep models relevant. Rapid detection of discrepancies, real-time updates, and model adaptation are critical for practical applications. Additionally, decision-makers often struggle to interpret OR model results, which can be complex and unintuitive. Unlike experts, managers typically use less formal, more verbal

reasoning. Interpretability is a two-way street: humans must understand machine outputs, and machines must capture human intent.

Recent literature has discussed interfaces of OR, digital twins and AI in different forms, e.g., supply chain digital twins, combining generative AI and optimization, integrating control theory and multi-agent systems, and using AI and computer science methods for solving manufacturing and supply chain problems. That said, we are not aware of any Special Issue in a leading international journal addressing this novel and rapidly developing field.

In this Special Issue, we call for papers seeking to advance state-of-the-art and practical applications on the interface of OR, DTs and AI. We aim at collating research combining OR methods with AI and DTs from different perspectives, e.g., cognitive and intelligent DTs (e.g., IoT-driven production planning and control); generative AI-powered optimization and simulation; AI-based analytics (e.g., machine, deep, and reinforcement learning) in OR models and algorithms; agentic AI, differential games and multi-agent systems. The papers in this SI should go beyond methodical integration and provide tangible contributions to one or several areas listed below:

- Use of AI and DTs in computational procedures of OR models
- Use of OR in AI and DTs
- Dynamic adaptation of OR models using AI and DTs
- Integration of OR models into DTs and agentic AI
- Combination of model-based (OR) and data-driven (AI) methods
- Learning-based and data-driven OR model building
- AI-based reasoning about OR modeling results
- Creativity and interaction of OR-based decision-support systems through DTs and AI
- DT and AI-driven ubiquity and synchronization for OR-based decision-support systems

> *We would like to stress that ITOR is an OR journal, and we expect to receive submissions that contribute (also) to OR, not (only) to AI. Papers about AI or digital twins without OR are out of scope of this Special Issue. We expect to receive contributions about interplay of OR, digital twins, and AI.*

Review Process and Timeline Review Process

The deadline for submissions is September 30, 2026. All papers submitted for this special issue will undergo the standard peer review procedures established by *ITOR*. Submitted papers must be original, unpublished, and not currently under consideration for publication elsewhere. All submissions must fit within the domain statement of the journal and will be judged for their relevance to the special issue's scope, innovativeness, and the extent of theoretical and practical research contribution. Contributions should be prepared according to the instructions to authors, which can be found on the journal homepage. Authors should submit and upload their contributions using the submission site http://mc.manuscriptcentral.com/itor, indicating in their cover letter that the paper is intended for this special issue. Other inquiries should be sent directly to the guest editors in charge of this issue:

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