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NUMERICAL MODELING AND DATA ANALYSIS FOR ADVANCING SUSTAINABLE INNOVATION

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ABSTRACT

The ubiquity of new technologies in our daily lives is steadily increasing, transforming our societies into interconnected and pervasive systems. In this context, numerical modeling emerges as a powerful instrument to comprehend real-world problems, providing qualitative and quantitative insights into their spatio-temporal evolution. By synergizing numerical modeling with information technology, novel strategies for sustainable development and innovation systems can be devised, thus optimizing industrial workflows and resource utilization.

The fruitful combination of numerical modeling, information technology, and data analysis reveals to be an impactful tool to address critical challenges in various domains, such as precision agriculture, energy management, predictive monitoring, and transportation.

Precision agriculture, empowered by sensor technologies, offers real-time assessments of crop health and needs, leading to optimized resource allocation (e.g., water and nutrients). The integration of computational methods, Internet of Things (IoT), and artificial intelligence further enables proactive measures to prevent potential harm to crops, significantly enhancing agricultural productivity.

Likewise, the realm of energy resource management, with a specific focus on Smart Grids, benefits from similar approaches. By leveraging mathematical modeling and data analytics, efficient energy consumption and reduced emissions become attainable goals. Moreover, adopting innovative hardware and software technologies in data centers plays a crucial role in achieving energy-efficient solutions and minimizing environmental impact.

Sustainable design considers environmental impacts throughout a product's life cycle, from raw material extraction to disposal or recycling. Multi-Criteria Decision Aiding (MCDA) helps decision-makers assess various factors simultaneously to balance conflicting objectives and make eco-friendly choices in infrastructure and product design. The integration of MCDA in sustainable practices fosters responsible decision-making and a collective effort towards a more environmentally conscious and sustainable future.

This mini-symposium aims to present and discuss exemplary experiences within the aforementioned areas, emphasizing mathematical modeling and efficient computational methods for simulating and analyzing complex real-world problems. Additionally, the focus will be on methodologies related to sensor data analysis and automated decision-making processes. Particular emphasis will be devoted to the tangible impact on sustainability resulting from the application of such cutting-edge approaches.

Indicative topics for presentations and discussions include, but are not limited to:
- Data-driven modeling and analysis;
- Numerical modeling of vegetation problems;
- Simulation of material deterioration dynamics;
- Machine Learning applications;
- IoT for sustainable practices;
- Smart Agriculture;
- Multi-Criteria Decision Aiding;
- Green and digital transformation through IoT;
- Recommender Systems for sustainable choices;
- Green computing and sustainability in ICT;
- Efficient solutions for sustainable data centers;
- Sustainable supply chain management.

By fostering interdisciplinary discussions and knowledge exchange, this mini-symposium aspires to advance the field of sustainable development and inspire further research in the integration of mathematical modeling, computational methods, and information technologies for a more sustainable future.