Special Issue

Computational and Data-Driven Modeling for Materials, Design and Construction

Message from the Guest Editors

The traditional paradigms of the building and construction industry are undergoing a radical transformation driven by the integration of computational and data-driven modelling for materials, design, and construction methodologies. This issue focuses on heuristic-based workflows to integrate digital pipelines that leverage high-performance computing and machine learning to optimize the built environment. Core themes of this Special Issue

- Multiscale Material Modelling: Advances in computational mechanics for simulating behavior from micro-scale to structural levels. Includes "bottom-up" design of bespoke materials—like carbon-sequestering concrete or high-performance composites—tailored for environmental stresses.
- Generative Design & Optimization: Algorithmic frameworks exploring multidimensional solutions to prioritize structural efficiency, thermal regulation, and material minimization beyond manual iteration capacity.
- Data-Driven Predictive Analytics: Utilizing AI and ML to predict structural health, timelines, and life-cycle costs. These models augment finite element analysis to provide real-time insights and reduce the "uncertainty gap" in complex environments.

Guest Editors

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About the Journal

Message from the Editor-in-Chief

Current urban environments are home to multi-modal transit systems, extensive energy grids, a building stock, and integrated services. Sprawling neighborhoods are composed of buildings that accommodate living and working quarters. However, it is expected that the cities and communities of the future will face complex and enormous challenges, including maintenance, interconnectivity, resilience, energy efficiency, and sustainability issues, to name but a few. A smart city uses advanced technologies and a digital infrastructure to improve the outcomes in every aspect of a city's operations. A smart building optimizes the experience of occupants, staff, and management by using a modern and connected environment. Innovations in technology that can bring dramatic improvements to design, planning, and policy are critical in developing the cities and buildings of the future.

Editor-in-Chief

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