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Editorial

Rethinking and Governing Cities: Scientific and Engineering Challenges of Complex Giant Systems

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Modern cities are open, complex giant systems shaped by the continuous evolution of human society. They serve as the principal arenas of social activity, economic development, technological innovation, and cultural inheritance, while also constituting critical foundations of national development and security. As cities continue to modernize, their systems are becoming increasingly interconnected, heterogeneous, open, and emergent.

At the most fundamental level, an urban giant system is formed by the deep integration and dynamic coupling of four interdependent domains, i.e., production, living, ecology, and governance. Together, they create a spatio-temporally interconnected system involving multiple scales, actors, and processes. Within this system, four critical infrastructure networks, namely, energy, communications, transportation, and water supply and drainage, form the backbone of urban functions. These infrastructure systems are tightly coupled and mutually dependent. Disruptions in any single subsystem can cascade through these interdependencies, potentially leading to widespread failures and even the partial or systemic paralysis of urban functions. Such interdependencies reveal the inherent vulnerability and systemic risks of modern urban giant systems.

Amid a new wave of technological transformation and profound changes in cities worldwide, the way urban giant systems are understood and studied is rapidly evolving beyond the boundaries of individual disciplines. In China, this transformation is unfolding against several major trends, including intensifying global climate change, a shift from expansion-led urbanization toward the renewal and more efficient use of existing urban assets, the continued pursuit of carbon peaking and carbon neutrality, and the pervasive integration of digital and intelligent technologies. Cities must simultaneously address growing demands for enhanced safety and resilience, green and low-carbon transformation, urban regeneration, climate adaptation, digital empowerment, and higher-quality sustainable development.

Against this backdrop, three fundamental questions have become increasingly important: How can cities be understood? How can they be sensed? How can they be effectively governed and steered? These questions represent systemic challenges that transcend conventional disciplinary, hierarchical, spatial, and temporal boundaries. Addressing them calls for the development of a new interdisciplinary field: Urban Science and Engineering.

ENGINEERING Cities was established in response to this emerging scientific need and transformative era. As an important companion journal to *ENGINEERING*, the flagship journal of the Chinese Academy of Engineering, *ENGINEERING Cities* is grounded in engineering science and practice and focuses on cities as complex giant systems. Its mission is to advance a new body of knowledge for understanding, sensing, and governing cities. The journal is concerned not only with engineering problems in cities, but more fundamentally with the city itself as a complex giant system, as well as the new scientific questions and engineering challenges arising from the extraordinary complexity of urban systems.

Accordingly, *ENGINEERING Cities* focuses on major areas including complex urban giant systems, urban safety and resilience, urban renewal and sustainable development, climate change and urban environments, digital twins and smart cities, and urban governance. The journal seeks to promote an integrated system of engineering science and technology across multiple

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spatial scales, from materials and structures to infrastructure networks and entire urban systems; across multiple temporal scales, from seconds and hours to days and historical timescales; and across multiple dimensions encompassing physical, social, and information systems. Through this broad and integrated perspective, the journal aims to contribute to the establishment and advancement of Urban Science and Engineering as an emerging interdisciplinary field.

Positioned at the forefront of global urban transformation, *ENGINEERING Cities* upholds scientific rigor while embracing innovation, promotes interdisciplinary integration, remains firmly connected to engineering practice, and supports sustainable urban development. The journal aspires to provide a high-level international platform for leading scientists, engineers, and scholars of urban governance to exchange ideas and translate research into practical impact. By breaking down disciplinary boundaries and bringing together advances from across the world, the journal seeks to accelerate a paradigm shift in urban science and engineering. This shift will move the field from experience-driven approaches toward mechanistic understanding, theoretical modeling, precise governing, and intelligent designing.

As *ENGINEERING Cities* begins this new journey, we warmly invite scholars and professionals around the world to join us in advancing the frontiers of research on complex giant systems, addressing the fundamental challenges facing modern cities, and contributing original scientific theories and new engineering solutions for cities that are more innovative, livable, sustainable, resilient, culturally vibrant, and intelligent.