

Preface: Technical Commission I (Sensor Systems) – ISPRS Archives

Xinming Tang ¹, Antonio Maria Garcia Tommaselli ², Tao Zhang ³

¹ Southeast University, China - tangxinming99@qq.cn

² São Paulo State University, Brazil - a.tommaselli@unesp.br

³ Land Satellite Remote Sensing Application Center, Ministry of Natural Resources, China - zhangt@lasac.cn

Sensor systems constitute the foundation of geospatial data acquisition and are undergoing a profound transformation driven by advances in sensing technologies, intelligent algorithms, and computing infrastructures. Modern sensor systems are becoming increasingly integrated, autonomous, and intelligent, enabling the acquisition of high-quality geospatial information across spaceborne, airborne, mobile, and terrestrial platforms. The fusion of multi-sensor technologies, artificial intelligence, and digital infrastructures is creating new opportunities for photogrammetry, remote sensing, mapping, and spatial information services.

ISPRS Technical Commission I serves as an international platform for the advancement of sensor systems and their applications in geospatial sciences. The commission promotes research on the design, calibration, modelling, integration, and validation of imaging and non-imaging sensors, including optical, hyperspectral, thermal, LiDAR, SAR, and emerging sensing technologies. It also fosters innovation in multi-sensor systems, positioning and navigation technologies, intelligent perception, and geospatial information production.

This volume of the International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences presents peer-reviewed contributions accepted in the ISPRS Congress related to TC I. The papers reflect the current research in sensor systems and demonstrate how advances in sensing technologies are enabling new levels of automation, accuracy, and intelligence in geospatial data acquisition and analysis.

A major theme throughout this volume is the continued evolution of integrated sensing and positioning systems. Some contributions address challenges in simultaneous localization and mapping (SLAM), LiDAR-inertial navigation, GNSS-assisted positioning, mobile mapping, and autonomous perception. These studies highlight the growing demand for reliable geospatial sensing in complex and GNSS-denied environments, supporting applications ranging from autonomous vehicles and robotics to indoor and urban mapping.

Another significant focus is the development and quality control of advanced sensor systems. Contributions explore calibration methodologies, geometric and radiometric performance assessment, image quality evaluation, and uncertainty analysis for satellite, airborne, and mobile sensors. Such work provides essential foundations for ensuring the accuracy, reliability, and interoperability of increasingly sophisticated sensing platforms.

The volume also demonstrates the impact of artificial intelligence and foundation models on geospatial sensing. Research on GeoAI, deep learning, self-supervised learning, semantic segmentation, intelligent feature extraction, and automated mapping illustrates how data-driven approaches are reshaping geospatial workflows. These advances are enabling more efficient interpretation of large-scale earth observation data and accelerating the transition toward intelligent geospatial production systems.

A further theme is the emergence of digital twins and integrated geospatial information infrastructures. Contributions investigate digital twin generation, BIM integration, 3D reconstruction, urban and environmental modelling, and space-air-ground sensing networks. Together, these studies reflect a broader shift from data acquisition toward dynamic, continuously updated representations of the physical world that support monitoring, analysis, and decision-making.

Beyond methodological innovation, the papers showcase diverse applications in forestry, agriculture, infrastructure monitoring, cultural heritage preservation, maritime surveillance, environmental assessment, and urban management. Collectively, the contributions illustrate the expanding role of sensor systems in addressing scientific, societal, and operational challenges through intelligent geospatial technologies.

We would like to express their sincere gratitude to all authors for their valuable contributions, and to the reviewers and members of the Scientific Committee for their dedication and professional comments. We also thank the ISPRS Congress organizers and local hosts for their hard work. We hope that this volume will provide a valuable reference for researchers worldwide and contribute to continued innovation and collaboration in the field of sensor systems.