

ARCHITECTURAL ENGINEERING IN ITALY AND WORLDWIDE COMPARING EXPERIENCES

Book of Abstract

Editors

Rossella Corrao,

Tiziana Campisi, Simona Colajanni, Manfredi Saeli, Calogero Vinci



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Introduction

Ar.Tec, the Italian Scientific Society of Architectural Engineering (AE), is responsible for organizing the annual Colloqui.AT.e conferences on themes of great relevance in the Built Environment sector, with the aim of promoting the cultural and professional development of scholars, researchers, and practitioners in the field of building construction and architecture. More particularly, the events seek to promote the dissemination of the research findings from the academic community, stimulating the evolution of the scientific activity among the associates in response to the rapid changes in the field of AE, as well as to support the qualified training of the future academic figures.

Architectural Engineering plays a central role in the education of both engineers and architects, serving as a bridge between the two worlds of architectural design and technical feasibility. It examines the boundaries where the goals of architectural projects meet with performance requirements and technological standards. In fact, the scientific-disciplinary contents focus on the Built Environment, addressing its multifaceted architectural, typological, constructive, functional, and performance characteristics.

Architectural Engineering provides students during their training as engineers and architects, tools, methods, and models for the critical, technological, and systemic knowledge of the Built Environment. It enables the assessment of the performance and impacts of both existing and new buildings, evaluates technological solutions at various project scales, and analyses complex systems to identify intervention scenarios, provides processes, tools, and models to improve the safety, resilience, and sustainability of the built environment.

In particular, the contents of AE focus on: the technologies of architecture and construction systems, including their historical development; technologies for the construction and rehabilitation of buildings; the design, testing, and innovation of materials, components, and systems; the integrated design of buildings; the analysis of performance and economic-environmental impacts of buildings, extended also to the urban scale; the analysis and quality control of projects and construction works; and the management of building design and maintenance processes.

In 2024, the annual Colloqui.AT.e conference is hosted at the University of Palermo. As in all previous editions, Colloqui.AT.e 2024 offers all participants the opportunity to share their technical and scientific experiences. Starting from this year, it also includes the experiences of architectural engineers from international universities, in line with theme of the event: Architectural Engineering in Italy and Worldwide. Comparing Experiences.

As before underlined, AE has been identified as the academic discipline with the highest potential in the fight against climate change. It promotes the construction of sustainable, resilient, adaptive, and high-performance buildings to meet the needs of increasingly evolving, sophisticated, and cutting-edge users. In countries with a high Human Development Index (HDI), these users push designers to rapidly think about new ways of inhabiting buildings and cities to ensure the well-being, safety, and health of occupants, alongside the rational use of resources and the protection of the environment.

The gradual technological innovation and field experimentation, implemented over the years, aimed at constructing buildings and cities in different climatic contexts, exploiting materials that vary from country to country and using different cultural approaches, but always underlying the same need: building places for living, capable of measuring and composing the space “between earth and heaven” (as Heidegger stated during the 1951 conference “Building Dwelling Thinking”). This innovation led to the disciplinary definition of Architectural Engineering, which is capable, today, of providing “tools, methods, and models, including digital ones, for the knowledge and design of buildings, from the critical, systemic, functional, typological, technical, and constructive point of view”.

By comparing training, research, and project experiences, the role of the Architectural Engineer in Italy and worldwide is discussed, from the perspectives of design, construction, and building management, in the past and/or future.

The Architectural Engineering multi/interdisciplinary approach can effectively contribute to the analysis and resolution of problems affecting buildings, cities, and the built environment, in Italy and in the world, proposing innovative technical solutions, materials, and components to ensure the preservation of the identity of places.

This volume collects three valuable contributions of international keynote speakers that open the three conference sessions: James W.P. Campbell, Professor of Architecture and Construction History at the University of Cambridge and Director of Studies in Architecture and History of Art in Queens’ College, Cambridge, UK; Mattheos Santamouris, Scientia, Distinguished, Professor of High Performance Architecture at University of New South Wales (UNSW), in Sydney, Australia, and past Professor in the University of Athens, Greece; Joachim Eble, Architect, founder and owner of Eble Messerschmidt Partner, Tubinga, Germany, as the brief abstracts of their plenary sessions point out.

Built Environment and its relations with people, society, heritage, and technologies are the common points of discussion and dissemination for scientists who participate in the annual event of Colloqui.AT.e. All the presented contributions are collected in this volume and properly divided into three main topics:

- A_ Construction and Conservation History
- B_ Building Construction and Performance
- C_ Building Design and Technologies

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Digital Decision Support System Prototyping for Building Performance Analysis and Management

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Abstract

The ongoing transformation of the AECO sector towards digitalization has led to a growing need for digital decision support systems (DDSS) to aid in managing built heritage. While there have been many technological improvements in this area, creating these digital tools still demands substantial technical and financial investments and highly specialized IT competencies. To respond to this challenge, this paper presents BTwin, a toolkit developed to facilitate the prototyping processes of DDSSs for performance-oriented building management. This open-source software, implemented in Python, allows for integrating building data from multiple sources into graph networks, such as building information models and building performance simulations, meters, and sensors. This integration capability, supported by specific semantic and ontological rules, is complemented by the possibility of quickly displaying the data on interactive dashboards accessible to non-expert users. After explaining the theoretical framework behind the toolkit, the paper showcases its practical application in a university building, focusing on energy- and occupancy-related topics.

Keywords

Built Heritage, Decision Support Systems, Knowledge Graph, Digital Twin, Building Information Modelling