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Preface

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Preface

Innovative scientific methodologies and challenging projects marking future trends in the protection of cultural heritage have initiated through a holistic approach, by merging competence from the scientific fields of architecture, civil engineering, surveying engineering, materials science and engineering, information technology, and archaeology, a universal conversation among scholars, heritage professionals on restoration and conservation, stakeholders, industry representatives, and policy makers. The combined utilization of digital documentation technologies with innovative analytical and non-destructive techniques; numerical, computational; and 3D techniques; and archaeometric and archaeogene methods supports the development of a transdisciplinary multispectral modeling methodology towards the sustainable preservation of cultural heritage. Innovation is enhancing and revealing a critical dimension of the preservation of cultural heritage along with social participation and communication.

The 2nd International Conference on “Transdisciplinary Multispectral Modeling and Cooperation for the Preservation of Cultural Heritage: Recapturing the World in Crisis through Culture” (TMM_CH 2021), has been held during December 13–15, 2021, at the Eugenides Foundation in Athens, Greece, and discussed modern trends in the original agora of our technological and democratic roots.

The conference was organized by the National Technical University of Athens (NTUA) in cooperation with the Technical Chamber of Greece, under the patronage of H.E. the President of the Hellenic Republic, Katerina Sakellariopoulou, inaugurated by H.E. the Vice President of the Government of the Hellenic Republic, Panagiotis Pikrammenos, with benedictions bestowed by His All Holiness, Ecumenical Patriarch, Bartholomew I of Constantinople and His Beatitude Archbishop Hieronymus II of Athens and All Greece.

Distinguished scientists and representatives of the National Geographic Society, the Cultural Heritage Finance Alliance (CHiFA), the International Council of Monuments and Sites (ICOMOS), the International Committee for Documentation of Cultural Heritage (CIPA), the Organization of World Heritage Cities (OWHC), the European Society for Engineering Education (SEFI), the European Construction Technology Platform (ECTP) and the Hellenic Construction Technology Platform (HCTP), the International Federation of Surveyors (FIG), the World Monuments Fund (WMF), AHEPA Hellas, the Grand Priory of Greece at the Sovereign Military Order of the Temple of Jerusalem, the UNESCO Chairs on “Digital Cultural Heritage” and “Culture, Tourism, Development”, and other major international and European organizations, associations, networks, universities, and research centers in the field of cultural heritage preservation, vi Preface participated in the international Steering and Scientific Committees, and addressed the conference at the opening session.

At the 1st TMM_CH conference, which was held with great success in October 2018 at the Eugenides Foundation in Athens, with the attendance of 350 delegates from 22 countries, the emblematic rehabilitation of the Holy Aedicule of the Holy Sepulchre in Jerusalem was presented as an exemplary application, in the field of monuments’ protection, of interdisciplinary and multispectral collaboration, as an outcome of innovation in both research and implementation, with emphasis on technological advancements, not only intersecting all the scientific fields of engineering and natural science but also initiating an ongoing dialogue with the humanities, such as archaeology, theology, sociology, diplomacy, and tourism.

The 2nd TMM_CH conference focused on the latest developments in research and innovation and the identification of novel trends to build an interdisciplinary approach to conservation and holistic digital documentation of cultural heritage. The utilization and reuse of monuments, historic cities, and sites forms the framework for the sustainable preservation of cultural heritage, in accordance with the principles of a circular economy, in terms of the respect and protection of values, materials, structures, architecture, and landscape, with an informed society able to participate effectively in the policies that will design and implement the new strategies required.

Innovative knowledge transfer through practice and education is continuing the venture for the rehabilitation projects in the Church of the Holy Sepulchre, joining the National Technical University of Athens and La Sapienza University of Rome with the Bezalel Academy of Science and Arts in Jerusalem, in cooperation with Israeli Antiquities Authority, the Hellenic Research Institute of Alexandrian Civilization, and PerpetielSI SRL, through the Erasmus+ Strategic Alliance EDICULA “Educational Digital Innovative Cultural Heritage related Learning Alliance”.

The issues discussed within the 14 sessions and 14 panel discussions at TMM_CH 2021 were as follows:

- 1 The Holy Sepulchre rehabilitation project: an emblematic source of innovation;
- 2 Resilience to climate change, natural hazards, and pandemic risks - biosafety;
- 3 Novel educational approaches for the preservation of cultural heritage;
- 4 Preserving compatibility, the materiality and integrity of structures, and architectural authenticity;
- 5 Advanced nondestructive and structural techniques for diagnosis, redesign, and health monitoring;
- 6 Earthquake and structural rehabilitation;
- 7 Archaeology, archaeometry, and archaeogene;
- 8 Bridging heritage stakeholders, science, and industry;
- 9 Transdisciplinary dialogue for world heritage at risk: the exemplary Hagia Sophia;
- 10 Digital heritage: a holistic approach;
- 11 Green and blue deals for local and regional sustainable development: revealing and preserving cultural and natural assets for isolated areas development with social participation;
- 12 Green deal and blue deals for sustainable development of isolated areas: sustainable land management and rural and urban development through preserving, reusing, and revealing cultural heritage;
- 13 Historic cities and centers: new Reuse and preservation strategies applying a circular economy;
- 14 Recapturing the world in crisis through culture.

Sharing knowledge, experiences, and recommendations about sustainable cultural heritage approaches and practices, at a moment of great risk and a time of renewed possibilities, has reorientated conversation to explore the current conditions and contours of the world in crisis, recapturing itself through culture and re-launching development.

The TMM_CH 2021 conference was held at the Eugenides Foundation in a hybrid format. Due to the pandemic both onsite and online attendance was facilitated for oral presentations, in compliance with governmental directives against COVID-19. All sessions and panel discussions were accessible for the registered conference participants using the unique link in their personal conference ticket. The opening session and all panel discussions, as addressed to the general public, were livestreamed with free access via the conference’s YouTube channel and website.

The 2nd TMM_CH Conference was highly anticipated, attracting researchers from all over the world. It was held with great success, despite the pandemic, with the physical presence of 150 delegates and online attendance of 500 delegates in real time.

Striving to ensure that the conference presentations and proceedings were of the highest quality possible, we only accepted papers that presented the results of various studies focused on the extraction of new scientific knowledge in the area of transdisciplinary multispectral modeling and cooperation for the preservation of cultural heritage.

In total, 310 contributions were submitted, and 124 papers were accepted for oral presentation and publication (representing the work of 377 authors from 33 countries) after peer review and consequent revision, with a rate of acceptance equivalent to 40%. A single-blind peer review process was employed with each paper receiving, on average, three reviews. Accepted papers were published in this volume of Technical Annals.

The interdisciplinarity in the preservation of cultural heritage requires holistic documentation with the fusion of the various disciplines' data on 3D models. Computer aided design and advanced computer science methodologies support an interdisciplinary synthesis of the preservation state assessment, i.e. the evaluation of the rehabilitation achieved in respect of the integrity of materials and structures, throughout the design of the restoration of authentic architecture. In parallel, new technologies can be used to enhance research and education and communicate the reuse and exploration of cultural and natural assets, providing, through tourism, external economies to sustain local and regional development in a circular way.

Hence, 24 papers presented at the 2nd TMM_CH conference, integrating all of the above aspects, are published in this volume as a special issue “Transdisciplinary Multispectral Modeling and Cooperation for the Preservation of Cultural Heritage”. This is the first volume of the *Technical Annals – International Scientific Journal In Advances In Engineering* by the Technical Chamber of Greece (T.C.G.)

This edition would not have been possible without the commitment of the TMM-CH editors of this volume (Antonia Moropoulou, Haris Doukas, Charalambos Ioannidis, Sofia Avgerinou-Kolonia, Kyriakos Lampropoulos); as well as the valuable assistance of the editing team at *Technical Annals* (Fotini Kyritsi, Evridiki Karathanasi, Panagiotis Vrelos, Maria Sinigalia, Manolis Erotokritos, Isabella Tsavari, Dimitris Psarris), to whom we are most grateful.

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