Preface

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Biographical notes: Maurizio Angelillo is currently a Professor of Structural Engineering at the School of Engineering and Architecture of University of Salerno. He started his research on masonry, both from the theoretical and experimental point of view, since the early '80s, at the University of Naples. He has contributed to the advance, of masonry research by writing several papers concerning masonry structures published in leading journals, and being a Coordinator of intensive doctoral and postdoctoral courses on masonry. He is one of the organisers of the International Summer School on Historic Masonry Structures (https://www.himass.org/).

Roberta Fonti is an independent researcher at the Chair of Conservation-Restoration of Technical University of Munich. Before, she was a Postdoctoral Fellow at the Chair for Structural Design of TUM. She was trained in conservation-restoration, architecture and structural mechanics at the Reggio Calabria and Naples univeristies. In general, her interests in research are laying into preservation theories especially for heritage lacking integrity. She has been awarded a prize by the International Masonry Society (IMS) within the 10th IMC Conference in 2018, and the 'Kleine Fächer – Große Potenziale' Conference in Berlin in 2017 for her excellence in science.

1 Introduction

The potential harmful effects of the application of modern theories of strength of material into the analysis and retrofitting of historic masonry constructions has been reported by several scientists and practitioners all-around. One of the reasons for these was explained by Giuffrè in many occasions of public dissemination since the early eighties, in which he pointed out the futility of conventional mechanical testing of masonry, due to the fact that masonry itself is a structure and the quantification of local properties, such as the

mean strength and the state of stress, is both useless and impossible. As a consequence, the use of sophisticated models accounting for elasto-plastic interaction, contact and friction, crushing, damaging and degradation, adaptation, hysteresis, models that must be necessarily based on a detailed knowledge of the local material behaviour, are not the most appropriate tools for handling the structural assessment of masonry structures. Once the level of quality of the different types of masonry has been established and classified, models based on simplified assumptions, such as, for example, that proposed by Heyman, can be adopted by practitioners with confidence. The main message of Heyman's theory, taken up by a number of scientists such as Como, Livesley, Gilbert, in the years which followed the publication of his milestone paper *The Stone Skeleton* in 1965, is that masonry structures are essentially unilateral and that the theorems of limit analysis can be used to assess their stability. In the end, Heyman's model applies to structures composed of masonry elements having the *quality* of masonry, that is built with the rules of art and whose building blocks have a sufficient integrity.

The warnings of Giuffrè and Heyman, which are amongst many, have had been often left unheard and forgotten. Because of this, this special issue aims to collect contributions to a modelling of historic masonry constructions more sensitive to the characteristic features of those, while exploiting the historical dimension of the debate on the topic. Innovative approaches that are able to give full consideration to the unilateral behaviour of masonry constructions are expressly welcome, along with contributions whose purpose is to implement the qualitative characteristics of masonry into simplified numerical models. This first part of this special issue consists of six papers concerning these topics and focusing on this aim, as described in some detail by Prof. Gianmarco de Felice, in a deep and passionate 'Foreword' that we have the pleasure to host to complete and elucidate its background.

In particular, the papers by Brandonisio and De Luca ('Analytical modelling for the seismic assessment of pointed arches supported by buttresses'), by Ferrero, Rossi, Roca and Calderini ('Experimental and numerical analysis of a scaled dry-joint arch on moving supports') and by Iannuzzo, Van Mele and Block ('Stability and load-bearing capacity assessment of a deformed multi-span masonry bridge using the PRD method') are concerned with the analytical, experimental and numerical analysis of some special masonry structures. The contributions by Olivieri, Fortunato and DeJong ('A new membrane equilibrium solution for masonry railway bridges: the case study of Marsh Lane Bridge'), by Ramaglia, Lignola, Fabbrocino and Prota ('Structural analysis of historical masonry churches: the case study of S. Giuseppe delle Scalze (Naples, Italy)'), and by Cusano, Angjeliu, Montanino, Zuccaro and Cennamo ('Considerations about the static response of masonry domes: a comparison between limit analysis and finite element method') are concerned instead on the critical application of limit analysis-based models to some real case studies.