

Preface

The construction of earthquake resistant buildings was based for centuries on the observation of earthquake damage to the built environment and the adoption of corrective measures during reconstruction. As a result, the areas affected by earthquake disasters have served as large fields for testing construction practice, albeit in an uncontrolled way. The advent of laboratory-controlled experiments, in combination with field observations, allowed during the last decades a fast advancement towards what we know today as modern earthquake engineering, which required experimental tests to be representative of real conditions in the field. It meant the use of full-scale specimens, accurate control of boundary conditions and reliable readings of response, which implied continuous evolution of the infrastructure supporting the experimental tests, still today one of the main challenges in earthquake engineering.

Shaking tables and reaction frames/walls coupled with hydraulic actuators have been in use for more than half a century for carrying out experimental tests in earthquake engineering. This has permitted the development of new design procedures and innovative technologies for earthquake protection, as well as the calibration of numerical models. In Europe, experimental testing has been at the fore-front of pre-Normative research in support of the European standards for construction, in particular of EN 1998 (Eurocode 8: Design of structures for earthquake resistance), through the participation of smaller scale labs, mostly for testing of sub-assemblages and components, up to large laboratories for full-scale validation and demonstration tests. Geotechnical centrifuges have also been used in earthquake engineering for studying wave propagation and soil-structure interaction phenomena, for both surface and embedded structures.

In an effort towards capitalizing on the existing infrastructures in Europe for experimental testing in earthquake engineering, the European Commission financed the SERIES Project (Seismic Engineering Research Infrastructures for European Synergies, www.series.upatras.gr) under grant agreement n° 227887 of the Research Infrastructures Programme in the Seventh Framework Programme. The project was coordinated by Prof Michael N. Fardis of the University of Patras. It aimed at fostering a sustainable culture of co-operation among all research infrastructures, by taking advantage of their complementarities while at the same time bringing the less advanced infrastructures to the levels of the most advanced ones. A major part

of the project was devoted to transnational access of users to a world-class portfolio combining Europe's largest facility for pseudo-dynamic testing, four diverse shake tables and two centrifuges. The project also envisioned joint research activities towards new fundamental technologies and innovative techniques, promoting efficient and joint use of the research infrastructures.

In this volume, experts from Europe, USA and China present their work in the three areas addressed by the SERIES Project: networking, transnational access and joint research activities. The networking activities include the development of a public distributed database of past, present and future test results, distributed testing capabilities, hybrid simulation, telepresence, and protocols for qualification of Research Infrastructures. The results of transnational access activities are presented for a number of projects among the 27 carried out at the seven large-scale infrastructures of SERIES, ranging from the retrofit of existing to the design of new reinforced concrete, steel, masonry and wood structures, as well as soil-structure interaction and wave propagation. The joint research activities explored novel techniques for better control of fast tests or special applications, new sensing and instrumentation systems, data assimilation in equipment-specimen models for better test control and optimisation of testing campaigns, as well as experimental studies of soil-structure interaction.

The SERIES concluding workshop on "Earthquake Engineering Research Infrastructures" was held at the Joint Research Centre of the European Commission at Ispra, Italy on May 28–30, 2013, jointly with the George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES, USA). The workshop attracted a large audience to listen to renowned experts from around the world presenting close to 55 invited contributions. The event was dedicated to the memory of Prof Roy Severn, who established and led the EQUALS facility at the University of Bristol and co-ordinated seismic infrastructure projects which preceded SERIES in past Framework Programmes, notably ECOEST I and II and ECOLEADER.

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