PREFACE TO THE SPECIAL ISSUE OF WG5 ON "NEW DIRECTIONS FOR SHELL STRUCTURES"

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We, the new co-chairs of IASS Working Group 5, are delighted to present this special issue that sets out new directions for shell roof structures.

The fast developments in the last decades in computer-aided modeling, computational methods, bespoke prefabrication and construction-scale digital fabrication, and new materials have resulted in a revival of research on shell structures. The selection of papers in this special issue represent some of the recent efforts and new developments in this area. Most challenges to bring back shell structures after they practically disappeared after their heydays in the 1920s-70s, relate to how to realize them in a reasonably cost-effective and practically feasible manner, reducing labor and/or material resources.

This issue addresses these key challenges, from the point of geometry, design and analysis methods, construction and assembly, novel material systems, etc. A first series of papers focuses on new design and analysis approaches for shell systems. For example, Mesnil et al. investigate the structural morphology and performance of plated shell structures with planar facets while Veenendaal et al. present the design, optimisation and engineering of a textile-reinforced, thin concrete shell project, built on a flexible cable-net and fabric formwork system. Malek et al. show how the magnetic field generated by the current in a wire can be used to form shells. In a second series of papers novel shell construction techniques are investigated. Eisenbach and Grohmann show strategies to use prefabrication and appropriate joining techniques to build slender concrete shells and Cuviliers et al. present a prototype of a hybrid elastic gridshell and fibre-reinforced concrete skin. Finally, a third series of papers focuses on alternative material systems and applications. Scheerer and Curbach give an overview of applications of textile-reinforced concrete in Germany and Michiels et al. investigate bamboo grid roofs, while Kaemper et al. show the optimisation of concrete shells for parabolic collectors.

Most articles were selected from special sessions on shell structures at the IASS Symposium 2015 in Amsterdam, Netherlands and 2015 SPP1542 Annual Meeting, Ruhr-University, Bochum, Germany. The guest-editors would like to thank the president of the IASS, Sergio Pellegrino, for supporting this special issue and Charis Gantes, and Asuncion Morales Hortelano, the editor and associate editor of the Journal of the IASS, respectively, with their support in the editorial process. We are also grateful to the previous chair of Working Group 5, John Abel, for assuring a smooth transition of knowledge and expertise and bringing shell research into the 21st century. Lastly, we would like to thank all contributors for being part of this special issue and writing high-quality papers, but also all reviewers whose comments helped to improve the papers significantly.