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Shell-like Structures

Non-classical Theories and Applications

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Preface

Shell-like structures are used in Civil and Aero-space engineering as basic structural elements. As a model of analysis are also used such structures in other branches, e.g. Mechanical engineering, but also in new branches like Medicine and Biology. New applications are primarily related to new materials—instead of steel or concrete, now one has to analyze laminates, foams, functionally graded materials, nanofilms, biological membranes, soft tissues, etc. The new trends in applications demand the improvements of the theoretical foundations of shell theory, since new effects must be taken into account. For example, in the case of small-size shell-like structures (thin films, multiwalled nanotubes) the surface effect plays an important role in the mechanical analysis of these structural elements.

Scientific meetings like conferences or colloquia are regularly organized by civil engineers, mathematicians, etc. Within the EUROMECH Colloquium 527 **Shell-like structures – Non-classical Theories and Applications**, which will bring together specialists from different areas, various items related to the colloquium title are discussed by international experts. The forum was addressed to scientists and researchers from industries. The focus was related to the following problems: new theories (based on two-dimensional field equations but describing non-classical effects), mathematical methods, e.g. the asymptotical analysis, new constitutive equations (for materials like sandwiches, foams, biological membranes, etc. and which can be combined with the two-dimensional shell equations), complex structures (folded, branching and/or self-intersecting shell structures, etc.) and shell-like structures on different scales (thin- and nanofilms, nanotubes, and nanoparticles) or very thin structures (similar to membranes, but with bending stiffness). In addition, coupled effects, phase transitions in shells and refined shell thermodynamics are discussed.

This book contains papers submitted before the above mentioned colloquium. The reason for publication on such early stage was that a lot of the tentative colloquium participants gave a positive response on our call to publish their contribution in advance. By this way each participant is informed in some details about the forthcoming presentations at the beginning of the conference, which

stimulates a deeper scientific discussion. Finally, more than 50 papers were received and after reviewing 48 were included in this volume. It should be mentioned that some very long submissions (over 50 pages) were rejected and shorter versions were prepared for publication in this volume. The Full-length contributions will be published in the *SpringerBriefs* (<http://www.springer.com/briefs>) in 2011.

This book deals with various items of the theories of shells, plates, beams, etc. In addition, traditional and new applications are presented. Its contents is split into 8 parts:

- Mathematical Problems
- Dynamics and Stability
- Nonlinear Models and Coupled Fields
- Numerical Analysis
- Engineering Design
- Micro- and Nanomechanical Applications
- Biomechanics
- FGM and Laminated Plates and Shells

This monograph is not only based on the authors' contributions. The publication and the conference were supported by different organizations and you can find some personal acknowledgements at the end of various papers. Here we acknowledge our main supporters:

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Prof. Dr. Holm Altenbach
Prof. Dr. Victor A. Eremeyev

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