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## **Editorial**

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With recent rapid advances in structural engineering, as well as its closely related areas including mechanics and materials, many new types of structures and new analysis methods are proposed and developed. This is a special issue on new structures and new analysis methods. It contains ten technical papers, focusing on special structures like pneumatic or tensegric systems, and the analysis and design methods for them. An overview of these papers is given as follows:

Presented by Ruy Marcelo de Oliveira Pauletti, 'Some issues on the design and analysis of pneumatic structures' is a paper for the tensile structures par excellence, pneumatic structures, with which it is possible to have all elements working in tension. The evolution of pneumatic structures is described here, as well as several issues related to its design. It also presents several selected civil engineering applications, designed by means of simple numerical models.

'Overall stiffness evaluation and shape optimisation of a tensegric structure' is studied by Pei-Shan Chen for the shape optimisation of tensegric structures. General reduced gradient method for maximum overall stiffness is promoted, as well as a study on the overall stiffness of a tensegric structure. A tensegric dome is taken as an example for the numerical demonstration and analysis compared to that of the initial shape.

The design, development and research build process of a new generation of shell roof structures for architecture is described by Mick Eekhout in 'Composite stressed skin roofs for liquid design architecture'. The result marks a new era, the renaissance of the shell structures, whose geometry is more free and complex, with the principal idea from aeronautic and yacht design. The production stage of the architectural application is greatly assisted by the transfer of technology from yachting industry.

The history of morphological indicators (MI's), which is used for guiding the structural designer towards low volume consuming solutions is presented by Ir. T. Vandenberg and Ir. W.P. De Wilde in 'A review on conceptual design with morphological indicators'. It especially surveys the milestones that lead to today's method and contains the published references that contributed to the major evolutions of MI's.

The existence of alternative forms of the rolamite hinge by changing the profile of the rollers is investigated by Maria Tupputi in 'A bi-stable rolling hinge for variable geometry structures', with its aim to achieve a bi-stable rolling hinge that can be used to build a variable geometry structures (VGS) and stabilise it at some configurations. It also establishes the relationships concerned in both design and mechanical behaviour to provide a proper use of the hinge, which consists of two prismatic blocks held by three

wires, each wire is continuously wrapped around circle surfaces cut into a generic cross-section of both prismatic blocks.

'Experiment and non-linear analysis of stainless steel columns having variable cross-sections' is presented by Muhammad Ashiqur Rahman and M.A.K Chowdhuri, in which a useful numerical scheme, based on finite difference technique, is devised to trace the load-deflection curves (equilibrium configuration paths). Experiments and simulations of the results have also been accomplished for columns with varying cross-sections to prove good agreement between the present results of finite difference technique with those obtained from experiments.

The free vibration of multi-layered beam considering interlayer slip is analysed by Keiichi Inoue and Koichiro Ishikawa in 'Free vibration analysis of multi-layered beam members including the effect of interlayer slip'. It formulates the equation of motion for the free vibration analysis of multi-layered beam members and examines some analytical examples.

In 'Representation of connection behaviour for progressive collapse response', the component method of EC3 and EC4 has been developed for bare steel and composite connections respectively by P. Stylianidis and D.A. Nethercot, so as to incorporate the levels of axial load generated by the arching or catenary action seen at various stages of a step-by-step consideration of progressive collapse. They also presents closed form expressions covering the full range of loading and behaviour up to collapse, which have been validated against both the small number of available tests and results obtained from rigorous numerical analyses using ADAPTIC.

Stefan Trometer and Mathias Krupna presents the development of glass folded plate structures, where glass will not only be used as a transparent covering but as a load-bearing element for the whole structure, in 'Renaissance of paper models and folded plate structures in glass'. A complete outline ranging from the architectural approach to structural analysis is presented, and the structural concept and its functional characteristics confirmed by finite element analysis. It also put the geometrical diversity and individuality into focus and present mathematical algorithms as definitions of the geometrical freeform.

Scissor-hinged retractable membrane structures is a system for retractable membrane roofs that need a fully retractable supporting structure and multiple stable roof-configurations, which is presented by Tom Van Mele, Niels De Temmerman, Lars De Laet and Marijke Mollaert in 'Scissor-hinged retractable membrane structures'. The formation mechanism of the roof is introduced herein, as well as the transformation process.

Yao-zhi Luo presents some works on recent advances in configurations in spatial structures. He introduces a technique of reconstructing free-style 3D objects with grid space structures. With this technique, irregular and complex configurations can be easily modelled, which has a great potential in modelling of sculptures and bionic structures. He also presents some new deployable structures based on linkage mechanisms including Bricard linkages and double chain linkages. The kinetic behaviour of these deployable structures is investigated by geometrical analysis. And their possible applications in retractable roofs and erection technologies are investigated. He also presents some new advances in form-finding of tensegrity structures and shape control of tensegrity structures.