

ADVANCED STEEL CONSTRUCTION

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The International Journal of Advanced Steel Construction provides a platform for the publication and rapid dissemination of original and up-to-date research and technological developments in steel construction, design and analysis. Scope of research papers published in this journal includes but is not limited to theoretical and experimental research on elements, assemblages, systems, material, design philosophy and codification, standards, fabrication, projects of innovative nature and computer techniques. The journal is specifically tailored to channel the exchange of technological know-how between researchers and practitioners. Contributions from all aspects related to the recent developments of advanced steel construction are welcome.

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Book: [2] Chan, S.L. and Chui, P.P.T., "Non-linear Static and Cyclic Analysis of Semi-rigid Steel Frames", Elsevier Science, 2000.

Proceedings: [3] Zandonini, R. and Zanon, P., "Experimental Analysis of Steel Beams with Semi-rigid Joints", Proceedings of International Conference on Advances in Steel Structures, Hong Kong, 1996, Vol. 1, pp. 356-364.

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FOREWORD

This Special Issue of the *International Journal of Advanced Steel Construction* (IJASC) is devoted to several issues on which steel construction research focused recently its attention. Its publication is directly linked with the 6th International Conference on Advances in Steel Structures held in Hong Kong, China, on December 16-18 2009, which was attended by more than 300 participants from all over the world. The Conference comprised 24 parallel sessions and encompassed 16 keynote lectures and the presentation of 146 papers, co-authored by researchers originating from 19 countries and 4 continents. On the basis of the quality of the presentations, some authors were invited to submit enhanced versions of their papers for publication in IJASC – those included in this Special Issue successfully went through a rigorous peer-review and revision process.

The 7 papers appearing in this Special Issue address a wealth of topics related to steel and steel-concrete composite structures, ranging from bridges to buildings, from elastic and inelastic buckling to robustness. Such complex problems are tackled by means of experimental, analytical and numerical research approaches. They are presented following a sequence that starts with steel-concrete composite systems, covering several advanced issues of bridge analysis and members in compression and in bending, touches the important novel area of robustness of frames and, finally, reaches the domain of thin-walled members, including a numerical-experimental investigation on column mode interaction and discussing open issues in the design of industrial racks. Next, a very brief overview of the content of each of these papers is provided:

- (i) *Gara, Ranzi and Leoni* address the analysis of composite steel-concrete beams with partial interaction, accounting for the deformability of the shear connection. They use a FE numerical approach capable of capturing the beam structural response, including shear-lag effects and the concrete time-dependent behaviour. The versatility of the formulation is demonstrated for a wide range of realistic bridge arrangements, from twin-deck girders to cable-stayed bridges. The determination of steel effective widths and concrete stress distributions, as well as their variation in time, are also explored in the paper – these are important design issues.
- (ii) *Chan and Fong* present an experimental and analytical investigation on the use of bare steel and steel-concrete composite rectangular hollow sections (RHS) as truss and frame members. The study enables the quantification of the beneficial effects of the concrete infill on the truss ultimate strength. A comparison between the test results and the estimates yielded by design approaches prescribed by the appropriate Eurocode documents shows that second-order analysis leads to more accurate predictions than design methods based on the combined use of linear analysis and effective lengths.
- (iii) *Gardner, Chan and Abela* focus their attention on the structural behaviour of elliptical hollow sections (EHS) under combined compression and uniaxial bending (at the cross-sectional level). Structural performance experimental data, obtained through a series of stub column tests involving various load eccentricities, are supplemented with further numerical results, determined by means of shell finite element analysis. Slenderness parameters and limits for EHS under combined compression and bending were developed. The available data also led to the proposal and validation of an interaction equation for the design of EHS under combined loading.
- (iv) *Li G.Q., Li L. and Li X.* study experimentally a novel steel-concrete composite beam with an inverted T-shaped steel section and trapezoidal connectors. The investigation aims at developing design criteria for these connectors and covers all the main aspects of their response: the behaviour in shear (through push tests), in tension (pull-out tests) and under local compression – punch tests have also been carried out. Design equations to estimate the beam shear capacity, local compressive strength and punch capacity are proposed in this work.

- (v) *Nethercot, Stylianidis, Izzudin and Elghazouli* address design provisions aimed at ensuring adequate robustness to steel and steel-concrete composite building frames. Following an approach devised earlier, and taking into account parametric studies that provided insight into the link between changes in a structure and its resistance to progressive collapse, the paper examines a number of different frame arrangements, for which key behavioural features are identified. The structural modifications are then classified according to their potential for improving the frame robustness and quantitative measures are developed to assess the amount of improvement.
- (vi) *Baldassino and Zandonini* deal with the performance and design of industrial racks used for the storage of palletized goods. The large variability in terms of profile geometry, joints and perforations, as well the complexity of the phenomena affecting the member behaviour, do not yet allow the performance of a pure numerically-based design – instead, it is indispensable to carry out experimental tests, aimed at characterising the various structural components. Hence, the traditional design approaches combine experimental results and numerical analysis. This paper provides an overview of the experimental part of this approach, addressing both the European and North American standards. Open questions related to the clarity, accuracy and completeness of the current specifications are also pointed out and briefly discussed by the authors.
- (vii) *Dinis, Camotim, Batista and Santos* present a numerical and experimental investigation on the (elastic and elastic-plastic) post-buckling behaviour and strength of fixed cold-formed steel lipped channel columns undergoing local-distortional-global (flexural-torsional) interaction. The numerical results provide in-depth understanding on the column triple interactive behaviour, namely on how it affects the column ultimate load and collapse mechanism. The few experimental results displayed (a full test program is under way at the Federal University of Rio de Janeiro) clearly show the column strength erosion due to the mode interaction, thus confirming the numerical findings. The paper closes with some preliminary considerations on the applicability of the current Direct Strength Method expressions to handle the interaction phenomenon under consideration.

Before closing, we would like to thank the authors of the papers for the quality of their work, and also for their patience and support during the preparation and revision of the manuscripts – it was a real pleasure to interact and cooperate with each one of them.

Likewise, the help of the reviewers was greatly appreciated – their valuable criticisms and suggestions contributed decisively to improve the technical content of this Special Issue. The careful and extremely professional handling of all the publishing matters by Ms. Freda Chow also deserves a special mention.

Finally, we would like to express our sincere gratitude to Prof. Siu Lai Chan, Chairman of ICASS'09 and Editor-in-Chief of IJASC, for having adhered so enthusiastically to the idea of this Special Issue.

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