

# ADVANCED STEEL CONSTRUCTION

*an International Journal*

*Volume 1 Number 2 September 2005*



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## General Information

### *Advanced Steel Construction, an international journal*

#### **Aims and scope**

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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Journal: Chen, W.F. and Kishi, N., "Semi-rigid steel beam-to-column connections, data base and modeling", Journal of Structural Engineering, ASCE, 1989, 115(1), pp.105-119.

Book: Chan, S.L. and Chui, P.P.T., "Non-linear static and cyclic analysis of semi-rigid steel frames", Elsevier Science, 2000, pp.336.

Proceedings: 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 for the Inaugurate Issue of the International Journal of Advanced Steel Construction**

As clearly stated by professor Chen in the opening remarks to the first issue, the difficult mission of the Journal can be summarized in two words: innovation and creativity in steel construction. Research, technology and codes are considered in fulfilling this goal in the areas of design, analysis and practice.

It is not by chance that such an ambitious goal is defined for a new journal, which was born with Asia, and in particular China, in mind as the reference geographical area. The tremendous economical growth in this area represents an extraordinary challenge for the construction world. A response should be given, which should conjugate structural reliability with effectiveness and efficiency in time and cost. Such a requirement urges towards innovation and creativity and, even more important, towards the practical use of them. It is hence of great interest to the Journal to disseminate knowledge and information, which can find a significant echo within the Asian scientific community.

This second issue proceeds well along this general perspective, and deals with topics, which should be carefully considered by scientists, engineers and builders operating in the steel construction world. The papers cover important problems in fields such as frame analysis, new sections, new materials in composite systems and fatigue. Moreover, recent trends in seismic codes are presented, with reference to the 2005 Specifications of the American Institute of Steel Construction. Despite Code recommendations, by their very nature, can not be based on the most recent research findings, they provide a useful indicator of the evolution in progress in the 'philosophical' perspective, which lies behind design methods and rules.

Performance based design appears to be a powerful approach, which allows combination of reliability with economical efficiency. The basic concept has found application so far mainly in the field of seismic engineering, and, more in general, to the design of structures subject to accidental actions such as fire and explosion. Its extension to the design of structural systems under 'any' loading condition is welcome. Besides, it is foreseeable: the times are mature for that. Availability of advanced analysis methods is a necessary pre-requisite for performance based design of frame structures. They enable refined approximation of the system performance, catching all the various phases and the attainment of the relevant limit states. Despite some recent Codes, such as the Eurocode 3, provide general guidelines and data for applying nonlinear FE analysis, a greater effort is necessary to make the use of these methods more attractive and popular among practicing engineers.

Two interesting papers contribute to this line of development. The first by Agüero and Pallares presents a simplified second-order elastic analysis method to be adopted in association with equivalent geometric imperfections. The second by Chan and Chen elaborates on the comparison with traditional prescriptive design approaches and points out the advantages of advanced analysis in terms of both overall reliability and cost efficiency of the structure. Furthermore, it provides evidence of the general Authors' considerations by means of two remarkable examples, including an important recently constructed project.

Innovation in the cross-section of industrially fabricated profiles is nowadays fairly rare. However, oval hollow sections recently emerged as a new 'design option' enabling combination of architectural appeal and structural efficiency. However, their use is somehow hampered by the lack a validated set of specific design guidelines. The paper by Gardner reports on a wide series of numerical and experimental studies on elliptical sections subject to compression or in-plane bending. The results already available well agree with the preliminary design rules considered by the Author. Further work is needed for the full validation of these rules. However, the indications provided in the paper represent an important step towards a wider application of this new 'family' of sections.

Composite structural systems making efficient use of complementary properties of different materials and/or subsystems can be considered the core development, which to a large extent characterizes the future of the construction field. The design of new structural systems and the retrofitting of existing ones take both advantage of composite action. Of particular interest is the use of CFRP in strengthening steel structures. Design requires full understanding of the interaction mechanism based on the bond between steel and CFRP. The knowledge of this central aspect is not yet exhaustive, with particular reference to the potential range of relative stiffness properties of the two materials. The contribution by Fawzia et al. focuses on the influence of the CFRP modulus on the bond length and the ultimate capacity, and includes a prediction method proposed by the Authors, which appears to be rather accurate at least in the cases examined.

Finally, the paper by Xiong et al. deals with the relation between the elastic-plastic near crack tip response and the fatigue crack propagation, and demonstrates the significance of the plastic strain in compression. The ability of mastering the various aspects of fatigue in design is more and more important, due to its influence on the optimal design of a wide range of steel structures.

It is hence possible to conclude that all the papers in this issue fulfill the basic requirements inherently associated with the mission of the Journal.

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