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Steel Construction

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The cover shows the 3D rendering model for the design that won second prize in the design competition for the Italian presentation at EXPO 2010 in Shanghai, which was conceived by architect Prof. Arch. Tommaso Valle + Workshop 7 (Rome) and structural engineer Prof. Ing. Massimo Majowiecki (Bologna) (see pp. 3ff.).

(Source: Prof. Arch. Tommaso Valle, Rome)

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The international journal "Steel Construction – Design and Research" publishes peer-reviewed papers covering the entire field of steel construction research and engineering practice, focusing on the areas of composite construction, bridges, buildings, cable and membrane structures, façades, glass and lightweight constructions, also cranes, masts, towers, hydraulic structures, vessels, tanks and chimneys plus fire protection. "Steel Construction – Design and Research" is the engineering science journal for structural steelwork systems, which embraces the following areas of activity: new theories and testing, design, analysis and calculations, fabrication and erection, usage and conversion, preserving and maintaining the building stock, recycling and disposal. "Steel Construction – Design and Research" is therefore aimed not only at academics, but in particular at consulting structural engineers, and also other engineers active in the relevant industries and authorities.

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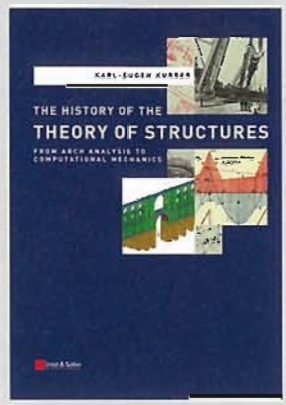
volumes entitled "La tour de trois cents mètres"? The 500 numbered copies destined for important personalities were simultaneously balance, gift and advertisement of *Eiffel*'s work. This new edition of the volume of plates presents the most beautiful part of *Eiffel*'s monumental publication: a collection of the drawings on 53 double-page plates, 12 photographs documenting the construction of the tower and a map depicting the entire area visible from the top of the tower. The texts for this new edition were written by *Bertrand Lemoine* (Paris), the foremost historian on iron and steel architecture whose writings on *Eiffel* have set standards in research into *Eiffel* and his work. *Maurice Koechlin*, a student of *Karl Culmann*, carried out the structural analysis of the Eiffel Tower, which was opened in 1889. *Koechlin* made use of *Culmann*'s graphical statics to calculate the internal forces, and three magnificent plates are preserved in the new edition. *Culmann* said "drawing is the language of the engineer", and the truth of this sentence exudes from the very pages of this spectacular new edition of the drawings and photographs from *Eiffel*'s book. The 700 general arrangement drawings and 3600 working drawings necessary for the construction of the Eiffel Tower were the output of 40 engineers and draughtsmen. It took less than 200 workers to erect the tower in 21 months, working to a finely tuned schedule on an excellently organised building site with an impressive record – only one fatality. *Lemoine* attributes *Eiffel*'s success as an engineering entrepreneur – especially in the field of iron bridges – to the convergence of several factors: "The story of Eiffel is not simply that of a brilliant engineer; it is also that of the company he founded and to which he gave his name. Beyond the epic tale of the individual, the progress of his business illustrates, in model fashion, how his success arose out of the conjunction of technical innovation, notably in construction processes, the mastery of industrial manufacturing, the insistence upon quality, the mobilisation of talents and capital thanks to the charisma of the founder, the exemplary organisation of production and distribution, the skilful negotiation of contracts, good public relations and the constant application of pressure in the right places. Eiffel built up his business just as he constructed his own myth – through his merits as an engineer and through his pronounced feel for commercial relations and his own publicity, which focused the success of his business on his person and on his name" (p. 6).

At the start of his book, *Eiffel* lists by name the 326 engineers, foremen and workers who were involved in the conception, design and building of the tower. But that was not enough for him: above the four main arches of the Eiffel Tower, the great man himself instructed that the surnames of 72 natural and engineering scientists, engineers and entrepreneurs be preserved on 72 cast-iron plates as homage to the triumph of scientifically based engineering. The names include those whose creative activities had a profound influence on bridge-building, theory of structures and applied mechanics: *Marc Seguin* (1786–1875), *Henri Tresca* (1814–85), *Jean-Victor Poncelet* (1788–1867), *Jacques Antoine Charles Bresse* (1822–83), *Joseph Louis Lagrange* (1736–1813), *Eugène Flachat* (1802–73), *Claude-Louis-Marie-Henri Navier* (1785–1836), *Augustin-Louis Cauchy* (1789–1857), *Gaspard de Prony* (1755–1839), *Louis Vicat* (1786–1861), *Charles Augustin Coulomb* (1736–1806), *Louis Poinsot* (1777–1859), *Siméon Denis Poisson* (1781–1840), *Gaspard Monge* (1746–1818), *Antoine-Rémi Polonceau* (1778–1847), *Benoît-Pierre-Emile Clapeyron* (1799–1864), *Jean Baptiste Joseph Fourier* (1768–1830) and *Gabriel Lamé* (1795–1870).

Although the company Atelier de construction d'Eiffel founded by *Eiffel* in 1866 was a leading French steelwork company with great successes on the international bridge-building market as well, it never became a large group. Following several mergers, Eiffel Construction Métallique was finally incorporated into the Eiffage Group in 1992. With a production capacity of 40 000 t of steel products per year and about 1000 employees, Eiffel Construction Métallique is today one of Europe's leading steelwork companies with such spectacular bridge structures to its name as the viaduct over the Tarn Valley at Millau (completed in December 2004); two towers of this cable-stayed bridge are more than 300 m high and are thus taller than the Eiffel Tower.

Nevertheless, the Eiffel Tower remains unsurpassed as a symbol of the synthesis of art, engineering and science. *Eiffel*'s stupendous literary monument "La tour de trois cents mètres" represents one part of this synthesis that should not be underestimated. And the wonderful drawings and photographs in this new edition are sensitively, thoughtfully embedded in the historical context with the help of *Lemoine*'s accompanying texts. The new edition is worth purchasing for its beauty alone. And what is beauty? According to *Jacob* and *Wilhelm Grimm*'s German dictionary of 1854, beauty "is no longer associated with desiring, but rather with stimulating and fulfilling that desire, and the gracefulness: beauty of life …; referred to as sensuous beauty …" The reader, looking at the coloured drawings, experiences not only "sensuous beauty", but also pure delight in discovering the history of building with iron and steel at the close of the 19th century – and *Lemoine*'s texts contribute significantly to the enjoyment.

Karl-Eugen Kurrer, Berlin



Kurrer, K.-E.: **The History of the Theory of Structures. From Arch Analysis to Computational Mechanics.**
Berlin, 2008: Ernst & Sohn. 848 pages, 667 figures. Hardcover, 17 × 24 cm.
ISBN 978-3-433-01838-5
US$ 155.00 / € 119.00 / £ 80.00

Following on from the success of the first, German, edition of his book "Geschichte der Baustatik", author *Karl-Eugen Kurrer* now presents us with the much larger second edition in English. Besides the obvious difference of the language, the whole book has been revised and considerably expanded. This review is therefore only a brief, very subjective first impression of the wealth of topics in this new edition.

The structuring principle of the book has been retained. Like the subtitle "From Arch Analysis to Computational Mechanics" leads us to expect, the evolution of theory of structures is not treated chronologically, but rather thematically. In doing so, important lines of development in the theoretical principles are explored, but the ways in which the building materials influenced the formation of theories are also presented, e.g. in sections on the development of iron bridge-building in the 19th century and the influence of reinforced concrete construction in the 20th.

In the chapters that have been carried over from the first edition, the ways in which international scientists and engineers influenced the development of theory of structures is shown in greater detail than in the first edition, particu-

larly those personalities from the USA, the UK, Belgium, Russia and Japan.

The reader discovers further differences simply by glancing at the table of contents. Totally new is the chapter covering the development of spatial frameworks, from the Schwedler dome of 1875 to the MERO System of *Max Mengeringhausen*. The chapter explaining the genesis of modern theory of structures now includes a stand-alone description of the development of the method of finite elements and the automation of structural analysis. Another new chapter groups together 12 scientific disputes, previously dispersed over the entire book, from the beginnings of theory of structures (*Galileo*) to the question of the right approach to soil mechanics (*Terzaghi* and *Fillunger*) and the debate surrounding plastic hinge theory (*Stüssi* and *Thürlimann*).

The section containing brief biographies of important engineers and academics as also been significantly enlarged. Readers with some knowledge of the lives and works of these personalities will be pleased to discover more, like how the pioneering work of *Fritz von Emperger* in concrete construction boosted the American cement industry, like *John Argyris*' escape over the Rhine in 1941, or the fact that *Edoardo Benvenuto* initially trained as a concert pianist before becoming a major driving force in establishing the history of mechanics and construction in the 1970s. And for those new to the subject of the history of theory of structures, it will be interesting to learn more about those who gave their names to the laws and methods used by structural engineers, e.g. *Culmann, Castigliano, Mohr* and *Cross*.

The final chapter looks at the perspectives for theory of structures and closes with a plea for the historico-genetic teaching of this subject. This education concept abandons the idea of dividing up teaching according to the traditional disciplines and instead places their similarities at the focal point of studies. In doing so, the modelling process from structure via loadbearing system to structural system is simulated in the curriculum. The concept therefore embodies a high degree of the practical bias so often called for these days.

Summary: This book offers fascinating insights into the emergence of theory of structures and structural analysis itself on various levels. The individual sections provide ample space for dealing with specific issues and details. The information is not laid out chronologically, but instead always in larger, thematically related contexts. Even the influences of civil and structural engineers in other technical fields such as cranes, shipbuilding and aircraft construction and, in turn, their influences on the theory of structures in construction can be found in this book. So on the whole a coherent picture of the development of theory of structures emerges. Recommendation: definitely worth reading!

Holger Eggemann, Brühl

News

New JRC-ECCS-Joint Report on Assessment of existing steel structures: Recommendations for estimation of remaining fatigue life

According to the agreement between the Joint Research Centre (JRC) of the European Commission in Ispra and the European Convention for Constructional Steelwork (ECCS) a series of reports are published as Joint-JRC-ECCS-Scientific Technical Reports, that may be downloaded from the e-bookshop of the Commission, see http://eurocodes.jrc.ec.europa.eu.

These Technical Reports are being prepared by experts from CEN/TC 250/SC3, the CEN-Technical Committee responsible for the preparation and further development of Eurocode 3, and from ECCS – Technical Committees related to the subject in question. They aim at:
- giving the scientific background and further explanations to the Eurocode 3-rules as published,
- presenting the state of the art and preparing the field for the maintenance, further harmonisation and further development of the Eurocode 3 rules.

A high priority project of CEN/TC 250 is to include in the Eurocodes technical rules for the assessment and retrofitting of existing structures, which becomes more and more important in the context of sustainable development in the construction field.

To this end a new JRC-ECCS-Joint Report has been published:

Kühn, B., Lukic, M., Nussbaumer, A., Günther, H.-P., Helmerich, R., Herion, S., Kolstein, M.H., Walbridge, S., Androic, B., Dijkstra, O., Bucak, Ö.: Assessment of Existing Steel Structures: Recommendations for Estimation of Remaining Fatigue Life (Background documents in support to the implementation, harmonization and further development of the Eurocodes), Editors: *G. Sedlacek, F. Bijlaard, M. Géradin, A. Pinto* and *S. Dimova*, First Edition, February 2008, EUR 23252 EN, ISSN 1018-5593, JRC 43401

This report deals in particular with bridges, because the enormous development of freight volume and traffic on roads and rails calls for the determination of residual safety and durability and rehabilitation methods in particular for bridges to adapt them to the new requirements and to lengthen their service life.

The new report has been prepared by Working Group A of ECCS-Technical Committee 6 – Fatigue – and contains principles and application rules as developed by the Joint-Committee of Structural Safety (JCSS), ISO-Committees and a recent FP-7-project on "Sustainable railway bridges". It represents a harmonized technical guidance giving rules of good practice for daily use and is suitable for being used as a technical basepaper for the future Eurocode-development in the steel field.

The next JRC-ECCS-Joint reports under preparation in the same domain will deal with fracture mechanics assessments (background of EN 1993-1-10) and determination of traffic loads on bridges (background to EN 1991-2).

Prof. Dr.-Ing. Dr. h.c. *Gerhard Sedlacek*
(ECCS – Director of Research)
Dr.-Ing. *Bertram Kühn*
(Chairman Working Group A)