



ENGLISH TEXTS



## TITLE OF THE ISSUE

**Engineering Today****RESEARCH****«Pop Structures» for the new Millennium***Tullia Iori, Sergio Poretti*

Could we recognize a baroque Style in a part of current structural engineering? Could we define a Baroque Engineering fashion? Transformed into an icon that should be appreciated and «bought» by an extraordinarily broad, multicultural audience, the structure enters triumphantly into the big world of pop art: this is the particular nature of the Baroque Style that involves the work of engineering.

Since the eighties of the twentieth century, there are many experiences in which the fundamental ethic and aesthetic principles of the classical engineering are blatantly breached. In these experiments the show is not the shape, more or less free, but the structural image. This should surprise no more for the daring, or the lightness, or the simplicity, but for the eccentricity of the equilibrium configuration: unexpected outcome (anything but natural, anything but cheap) of an inventive, sophisticated and (why not?) redundant game of forces. The endless catalog of new structural forms demonstrates the radical transformation of the figure of the structural engineer in recent decades. This transformation is certainly stimulated from the outside: by the same context switches that generate the ongoing revolution in architecture. But the outcome is accomplished effectively within the world of engineering, where it remains in close interconnection with the long path of a slow, painful history of maths and computers, algorithms for the optimization, more and more sophisticated materials, extraeuclidean geometries. The objective of this paper is mentioning a few crucial moments of this story internal to engineering.

**The beauty of calculation***Bruno Reichlin*

After more than a hundred years of promiscuous coexistence, of exposure to the architect's desire for admiration, to his exaggerations and his eternal quest for fresh beginnings, the engineer has gradually carved out an image for himself that is in some senses defined in opposition to the practices and prerogatives of the architect. This is not the place to weigh this historical "difference" in the balance, but we can at least attempt to trace its outline. The example of two of today's most exciting engineers, Santiago Calatrava and Jürg Conzett, will serve to give focus to our enquiry.

An extended English version of this paper is included in M. MOSTAFAVI (ed.), *Structure as Space. Engineering and Architecture in the Works of Jürg Conzett and His Partners*, AA Publications, Londra, 2006, pp. 18-31.

**«Toys and games»: Santiago Calatrava's Bridges***Rinaldo Capomolla*

Bridges constitute a representative and numerically important part of Calatrava's work. To determinate their structure, Calatrava doesn't base on well-known models, but – as he himself affirms – starts from the "creation of toys and games that can give plastic expression to the principles of statics"

«Toys and games» are arrangements of balanced objects, which he uses to identify new static organizations, capable to surprise the observer.

Similarly, his bridges appear as articulated groups of elementary structures, whose opposing effects counterbalance each other, in not always comprehensible ways.

Although with different exception, Calatrava's bridges are based on a single model: they are arched or on pylons structures, whose deck is supported by cables or rigid blades and it resists torsion effects. Most representative bridges are based on sloping and asymmetric arches (Gentil bridge, Alameda bridge, Campo de Volantin footbridge, Europe bridge) and on pylons not balanced by cables (Alamillo bridge, Sundial bridge).

Calatrava also utilizes more usual models, both arched, (Bach de Roda bridge, Lusitania bridge, bridge over Grand Canal) or with pylons and cables (Beckett bridge, bridges over the Hoofdvaart, Petah Tikva footbridge), but he always obtains original effects. For the Central Bridge of Reggio Emilia and Margaret Hunt Hill bridge, he presents an inedited model: the cables are anchored to a great midway transversal arch, instead of to a central pylon.

Carefully designed, both in relation with their surroundings and in their details, Calatrava's bridges are expressed in a so loud and appealing way that they become elements of valorisation for the places in which they are inserted.

Their most interesting aspect is the original way in which static rigour and formal freedom are combined.

**High fashion clothes, prêt-à-porter frames: contemporary skyscraper structural trends***Luciano Cardellicchio*

According with 2011 report of the Council on Tall Buildings and Urban Habitat, high-rises buildings developments have been rapidly increasing worldwide. Presenting the impossibility to compile a new classification for the primary structural system, this paper reviews the evolution of tall-building's structural systems. While most representative structural system are discussed, the emphasis in this review paper is on current trends

such as outrigger systems and diagrid structures. Learning from the past, it is also proposed the evolution of these two systems of truss force diagram, analyzing masterpieces of Fazlur R. Khan and Pier Luigi Nervi.

### **Italy 1990-2012: *Under-design*, or a project of technical and political anonymity**

*Luca Guido*

The paper examines Italian engineering developments between the early 90's and 2012, paying attention to bridges, footbridges, viaducts.

The critical and historical research analyzes some of the most important Italian engineering works, introducing them in the larger economic, political and legislative frame that has characterized the period 1990-2012.

### **Tensegrity Structures**

*Andrea Micheletti*

Tensegrity systems are prestressed pin-connected frameworks composed by bars and cables, with bars never connected to each other and cables constituting a connected set. Tensegrities have been first discovered in the late 1940's by Kenneth Snelson, when he was a student of Buckminster Fuller. Due to their distinctive features, these systems have attracted the attention of architects and engineers, resulting in various realizations and design proposals.

The aim of this work is to provide a comprehensive review of the relevant constructions and projects employing tensegrities. First, we introduce main concepts and principles by presenting the work of Snelson and Fuller. Then, we analyze the first large roof constructions, built starting in the late 1980's. Finally, we describe recent international projects and design proposals.

At present, there is little agreement on what should be considered a tensegrity system, with different authors adopting different definitions. This issue is also discussed here.

### **The necessity to begin, the sense of belonging: Itō Tōyoo's music test at the Matsumoto Performing Arts Centre (2000-2004)**

*J.K. Mauro Pierconti*

Ito Tōyoo facing the Music in the project of Matsumoto Performing Arts Centre (2000-2004). Unlike the precedent projects for the Nagaoka Lyric Hall (1996) and the Taisha Hall (1999), Ito looks for a space more representative, in a more physique way, of the sense, and the feeling of the Contemporary Music. The thoughts about the writings of the famous Japanese composer Takemitsu Toru (1930-1996) together with the works starting from the Sendai Mediateque show us a new way

of thinking that, in the field of performing arts, is producing a series of interesting theaters, like *Za-Kōenji*, finished in 2008, and above all the Taichung Metropolitan Opera House. But in the Matsumoto Centre we find the roots of the evocative idea that Music is something that needs a flowing space, according also to the sentence of Takemitsu in his writing *Nature and Music*: "Our task is to revive the basic power of sound ... [...]. I have referred to the 'stream of sounds'. This is not only an impressionistic description but a phrase intended to contrast with the usual method of construction in music –that of superimposing sounds one on another [...]. By admitting a new perception of space and giving it an active sense, is it not possible to discover a new unexpected, unexplored world? [...] The external and the internal world are full of vibration" [our italics]. In which way is possible to grasp such space, to make the sounds to resonate freely into the air is the topic point of the Matsumoto Centre.

### **Beginning millennium great works. Integrated architecture chronicles from two Italian construction sites**

*Giulio Barazzetta*

This paper examines the condition of current architectural design and construction in Italy, considering two exemplary «great buildings»: the new center of the Milan University Bocconi, completed in 2008, and the under-construction Napoli-Afragola High Speed Train Station, that is expected to open in 2013.

They both are considerable public works, indicative of the collective spaces of our cities; they are similar in terms of cost, but different for surface and functional program: a university and a train station, a disused area inside the city and a country area.

Despite the differences, the expected qualities and representativity are the same. Confronting the Bocconi centre – designed by earthwork and roofwork composition – and the Afragola Station – inspired by the travelling flows – tectonics and neo-tectonics of the last architectural season face each other, measuring differences and detecting analogies, that test idea and construction but also style and industry of the design.

### **Engineering from the World**

*Ilaria Palazzi*

The paper presents a selection of engineering works realized in the last twenty years. It doesn't want to be exhaustive, but only representative of some fundamental stages in the development of contemporary structures: cable-stayed and suspended bridges, stress ribbon pedestrian bridges, tensile membrane structures, skyscrapers, tensegrity structures, reinforced concrete thin roofs, have been selected in the international scenery to illustrate the course of structural engineering. Complicated solutions often conceal within viaducts, footbridges, stadia, museums, exhibition centers, airports, but also in some elements whose only function is to decorate urban landscape.

These works are the result of the collaboration between



some of the most important contemporary architects and engineers: Cecil Balmond, Santiago Calatrava, Jürg Conzett, Norman Foster, Buro Happold, Herzog & de Meuron, Toyo Ito, Marc Mimram, Richard Rogers,

Mutsuro Sasaki are some of the protagonists of the scene.

The works are presented in a synthetic way, paying attention to the most important structural features.

