

# Review

 **Robert Reitherman** is impressed by this forward-looking book which offers a future vision of creative engineers engaged in 'structural architecture'.

## Towards a new engineering: Reflections of a practitioner

**Author:** Mentor Lljunji

**Publisher:** MSPProject

**Price:** £25

**ISBN:** 978-9-940-66501-2



Mentor Lljunji has written a book from the practising structural engineer's viewpoint concerning the present and future states of the profession, a book that is very readable as well as providing a wealth of documentation (201 footnotes) and illustrations (138). There are many photos of completed projects, combined with computer graphics revealing the structure and simplified free-body diagrams sketched alongside to delineate forces.

Lljunji argues that computer technology is increasingly reducing the structural engineer to a technician who takes care of the bookkeeping of the digital output that software provides. He also states that the structural consultant is in an increasingly subservient role to the architect.

Better collaboration between the two design professions has often been advocated (though seldom realised). But, as Lljunji explores past eras of the relationship between structural engineering and architecture up to the present, he suggests instead that the future lies in the integration of both disciplines in the same person who practices what he terms structural architecture. (Readers may note that *Towards a new engineering* paraphrases the title of an influential book by the architect Le Corbusier.)

Many familiar names in the recent era are cited, e.g. Leslie Robertson, Guy Nordenson, Charles Thornton, Peter Rice, Fazlur Khan, Werner Sobek, Jörg Schlaich, Cecil Balmond, Bill Baker, Michel Virlogeux, Christian Menn and Laurent Ney.

Those familiar with the history of the field will also appreciate the many references to earlier

practitioners who spanned architecture and engineering in various countries, e.g. Pier Luigi Nervi (Italy), Gustave Eiffel (France), Vladimir Shukhov (USSR), Félix Candela and Eduardo Torroja (Spain), Robert Maillart (Switzerland), Joaquim Cardozo (Brazil).

A few quotes from the book illustrate its key themes.

Concerning computer automation of many structural engineering functions: 'For more than a century we traded creativity and invention for formulas and numbers. Today, numbers and formulas have been taken away from us (fortunately) and we are left with "nothing", no creativity and no numbers.'

The book argues that computers are not the problem. Hand calculations don't necessarily give the engineer a better feel for structural behaviour. However, he finds that engineers are increasingly becoming 'software operators'.

Architects of today tend to design buildings with random geometries that only software can analyse. The complex computer results may not sufficiently give the engineer a confident feel for how the structure behaves. 'The risk of architectural "shape-ism" consists of designing shapes which do not stem from and are not rooted in basic structural principles.'

On star architects and their increasing role as lead designers of not only buildings but bridges: 'The present tendency [is] to design bridges not as structural objects but as parts of the urban scenery – with the primary purpose of astonishing the public with aesthetic-structural acrobatics...'

On external form: '... the outer shape of the building is what determines authorship... The structural engineer should accept that... Only when in a position to give a building its outer shape, when the structure is architecture – only then will the structural engineer's contribution to a particular building be accepted.'

On building codes: 'Codes are written for less creative engineers who might design unsafe structures and are a product of sacrificing creativity for the sake of safety... Code complexity is not a guarantee of code accuracy.' Lljunji provides an interesting discussion of the underlying basis of the factors of safety published in codes, underlying data he thinks many engineers do not realise contain significant uncertainties and judgments.

Distinctions are drawn between what Lljunji calls 'structural architecture' and what Professor David Billington has widely published under the heading of 'structural art'. For example, Billington has used his definition to support his view that the Eiffel Tower is a great work of 'structural art', while the St Louis Arch is not. Lljunji finds this subjective and limiting. Lljunji's 'structural architecture' encompasses what he sees as the future for the creative structural designer.

The book carries its themes into the future with a discussion of the education of structural engineers. Lljunji concludes that, because of the growth of software and automation, in the future 'the structural engineer or consultant will be needed, but not nearly in the number they are today'.

To achieve structural architecture, he advocates broadening engineering education to include architectural design and art courses and to attract young creative designers to major in civil engineering. 'Despite all the remarkable examples of structural architecture created by structural engineers, the required curriculum in most engineering schools still does not offer any courses on engineering aesthetics or architecture.'

### Robert Reitherman

Robert is Executive Director Emeritus of the Consortium of Universities for Research in Earthquake Engineering.