# Review

**Martin Williams is impressed by this engaging book, illustrated with a wealth of real-world examples, that will prove useful to young engineers at the start of their career in structural design and construction.**

## Structural design against deflection

**Author:** Tianjian Ji
**Publisher:** CRC Press
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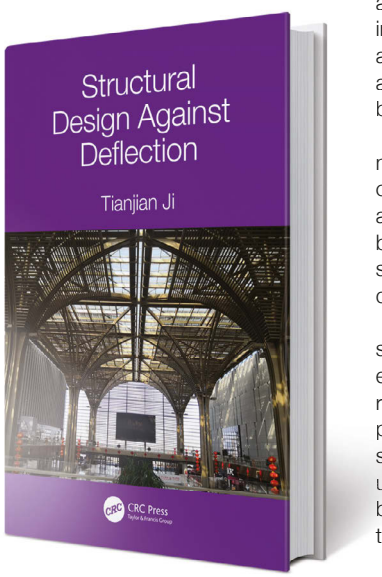


**WHEN I STARTED STUDYING** structures at university in the 1980s, we were given an excellent grounding in structural mechanics, in dealing with uncertainty in design, and in designing structures that were, above all, safe.

This was all important stuff, and I enjoyed it enough to make a career of it, but it was all a bit utilitarian. An interest in architecture, aesthetics or innovation was not particularly encouraged or nurtured.

The profession, and the way it's taught, have changed quite dramatically over the years. Today's students and engineers are fed a much richer diet, with a heavier emphasis on conceptual design, the relationship between physical form and structural efficiency, and the opportunity to work on projects that lift the spirits. This engaging book is reflective of that trend.

The book is built around four 'structural concepts' – really rules of thumb for good design – that emphasise that structural deflections can be minimised by using direct force paths, by aiming for as uniform a distribution of internal forces as possible, and by carrying loads by axial forces rather than bending.

These ideas are not new, e.g. we all know that only limited spans are achievable with beam bridges, and that tension structures such as suspension bridges offer a workable solution at much longer spans. But Ji goes on to explore the concepts in depth, in an accessible and readable way.

He does so through a combination of analyses of simple, idealised structural models that enable the effectiveness of his rules to be clearly quantified, and real-world examples that show the concepts being put into practice. The rationale for many well-known structural devices is thus clearly articulated, e.g. the use of overhangs to reduce bending moments in beams; the use of ties to reduce internal forces; and the use of inclined columns to minimise bending.

The example structures range from the relatively rudimentary, such as scaffold frames and temporary grandstands, to some highly sophisticated and iconic structures such as well-known US skyscrapers, Olympic sports halls and Calatrava bridges. Ji is well-travelled and has picked examples from around the world, including some excellent recent structures from the Far East, but also some on his own doorstep in Manchester.

The book is a nice complement to Ji's other book, co-written with Adrian Bell, on understanding structural concepts. While that earlier book is clearly pitched at undergraduate students, aiming to help them acquire a basic feel for different types of structural behaviour, this new book is more advanced, and feels to me like it would be most useful for young engineers at the start of their career in structural design and construction. But I can well imagine engineers further on in their careers finding it an interesting book to dip into.

> **"THIS IS A FASCINATING BOOK THAT TAKES A FRESH LOOK AT THE INTERPLAY OF FUNDAMENTAL STRUCTURAL PRINCIPLES AND THE BASICS OF GOOD DESIGN**

So, don't be put off by the rather dry title – this is a fascinating book that takes a fresh look at the interplay of fundamental structural principles and the basics of good design. It's generously illustrated by a wealth of real-world examples, which both promote structural understanding and give insights into the thinking behind some of the highlights of 20th and 21st century design.

**Martin Williams FIStructE**
Martin Williams is Professor and Pro-Vice Chancellor (Education) at Oxford University. He has around 30 years' experience of teaching and research in structural engineering, with a focus on dynamics, vibrations and promoting the understanding of structural behaviour.