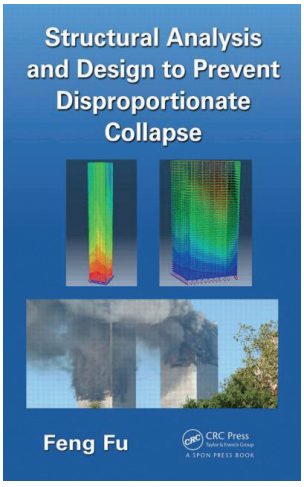
Review

The examples in the book will be useful to engineers looking to set up models in Abaqus to investigate the collapse behaviour of structures, believes Roger Davies, but less so to the more general reader.

Structural Analysis and Design to Prevent Disproportionate Collapse



Author: Feng Fu
Publisher: CRC Press
Price: £82.00 (hardback); £57.40 (E-book)
ISBN: 978-1-498-70679-7

It is a fundamental requirement of the UK Building Regulations that buildings are designed to prevent disproportionate collapse. Traditionally in the UK, this has been done using prescriptive rules, like the provision of ties at each floor level. The method is relatively simple to apply in most buildings.

However, the increasing complexity of modern buildings and, in particular, the widespread use of transfer structures has raised concerns about this approach. An alternative approach is available, namely the "removal" of an element or elements to determine how much of the structure would collapse; in practice, this can be difficult to apply.

This book attempts to advance the state of the art by showing how to create computer models of large structures that are then subject to an "event" to see if the subsequent collapse is progressive.

After a short introductory chapter, the book considers multistorey buildings, space structures and bridge structures, prior to returning to buildings with consideration of fire-induced collapse and buildings subject to blast load. The book closes with a concluding chapter. Most of the chapters open with a couple of examples of structures that have collapsed, before reviewing the current codes of practice and design methods. The author then runs through a computer simulation of some well-known structures or incidents – including the World Trade Center 1, Millau Viaduct, World Trade Center 7 and the Alfred P. Murrah Federal Building – appropriate for the particular chapter.

The second chapter has the largest review of national requirements from a number of countries from around the world. The selection of standards discussed highlights that the author has generally not included concrete structures in his consideration. Unfortunately, the chapter also highlights a recurring problem in the text, namely errors in referencing national standards, e.g. when referring to the Eurocode requirements, the section is titled ENV 1991-1-7 (BSI, 2006) and then later in the text referred to as BS 1991-2-7 (2006). I am particularly pleased to see that the ductility of the structure, in particular the connections, is discussed. This is something the UK codes of practice need to consider.

In the chapter on fire it is noted, correctly, that the main aim of structural fire design is to ensure that a building survives long enough for all of the occupants to escape from the building. What is not noted is that there is a general assumption that the fire is contained within one compartment. However, as the size of fire compartments is getting bigger due to the requirement for open-plan, adaptable spaces, the risk of a collapse occurring after the end of the fire-resistance period is probably increasing. A number of the fires discussed in the book extended to more than one fire compartment. The question as to whether a collapse is disproportionate in these circumstances is not discussed. I would suggest that, for economic reasons, the consideration of collapse would be desirable in some cases, not imperative as suggested by the author.

The computer simulations throughout the book have been run using Abaqus®. The book gives many partial input listings, screenshots of set-up dialog boxes and output screen shots. The usefulness of this will depend on which program the reader is familiar with and how "translatable" the information is to other programs. I do feel that, in a number of cases, it would have been better for the screenshots to have been produced to a larger scale. If the reader uses Abaqus, then this book should be of assistance to those who are setting up models to investigate the collapse behaviour of a structure. For the more general reader, the book, while making some good points, will be less useful.

Roger Davies
Roger Davies is a chartered engineer with more than 35 years' experience in the building industry. He has designed new buildings in all of the major materials and worked in the refurbishment and historic markets. Currently, Roger acts as an internal consultant for a major engineering consultant, advising colleagues on the interpretation of codes of practice and the Building Regulations.