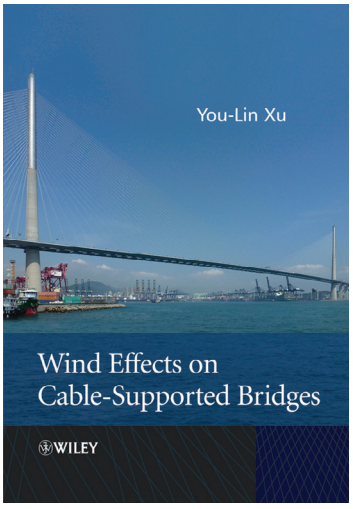
Review

This thoroughly researched book will appeal to doctorate-level academics and specialist consultants working on long-span cable-supported bridges, believes Matthew Myerscough.

Wind Effects on Cable-Supported Bridges



Authors: You-Lin Xu
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The stated aim of this book is to provide a comprehensive guide to the aerodynamics of cable-supported bridges, a subject absent from sóme university engineering courses, but one which is likely to become increasingly popular as demand for long-span structures continues. It is therefore Professor You-Lin Xu's intention that this work will serve as both a textbook for postgraduate students and an in-depth guide for practising engineers.

This specialist hardcover is well illustrated throughout and benefits from clear presentation. Although the content is divided into 16 chapters, I considered the book to comprise three principal sections.

The first, Chapters 1 to 6, covers the fundamental principles of bridge aerodynamics in detail and assumes little prior knowledge. Some of this material is taken from the author's long-standing lecture course on 'Wind Engineering' at The Hong Kong Polytechnic University. Types of cable-supported bridge and wind storm are discussed initially, including monsoons, tropical cyclones and tornadoes. The opening chapter also contains a brief history of bridge aerodynamics which attributes the birth of the discipline in part to the infamous collapse at Tacoma Narrows.

Chapters 2 to 4 introduce wind characteristics in the atmospheric boundary layer, mean wind load, and forms of wind-induced vibration and aerodynamic instability including vortex shedding, galloping and flutter. The fundamental theoretical content is largely concluded in Chapters 5 and 6, which discuss wind-induced vibration of stay cables and wind-vehicle-bridge interaction. It is the author's opinion that these initial chapters are suitable for postgraduate students; however, the subject matter is complex and multidisciplinary in nature, and there are no simplified example problems for students.

In the second section, Chapters 7 to 9 are concerned with the tools utilised to study bridge aerodynamics, and include wind tunnel studies, computational wind engineering, and wind and structural health monitoring. The chapter on computational simulation is understandably one of the most mathematically complex, and contains the lengthy derivation of formulae such as the famous Navier–Stokes equations. In order to appreciate this material, and indeed much of the other content in the book, the reader should possess a strong mathematical ability.

One of the strengths of this book is the frequent use of case studies to verify analytical methods. The author has extensively researched the effects of wind loading on two major bridges in Hong Kong, the Tsing Ma suspension bridge and the Stonecutters cable-stayed bridge. In Chapter 9 the monitoring results of the Tsing Ma Bridge during Typhoon Victor in 1997 have been included. Figures illustrating these data clearly indicate how the mean wind speed and direction altered as the eye of the storm crossed over the bridge. Details of the Wind And Structural Health Monitoring System (WASHMS) have also been included for the Tsing Ma Bridge.

The latter third of the book, from Chapter 10 onwards, is more advanced still and includes special topics such as buffeting response to skew winds, typhoon wind field simulation, and reliability analysis of wind-excited bridges. Much of this material is based on the author's own research, which stems from a career spanning over three decades. These chapters are more independent than earlier sections and could be used separately by experts.

While this publication is thoroughly researched and well written, I suspect it may be of limited appeal to students and postgraduates due to the significant complexity of the content following the introductory chapters. It would be better suited to the doctorate-level academic whom the extensive list of references at the end of each chapter could assist with further research. At over 700 pages long this is possibly the most comprehensive book to date on the subject, and I imagine it would be invaluable to the specialist consultant working on the design or structural health assessment of a long-span cable-supported bridge.

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Matthew Myerscough is a Bridge Engineer at Cass Hayward. He studied Civil Engineering at University College, Durham, and is currently enrolled on the Bridge Engineering MSc at the University of Surrey. Matthew has a particular interest in long-span structures and won the Institution's Husband Prize in 2014 for his suspension bridge paper.