

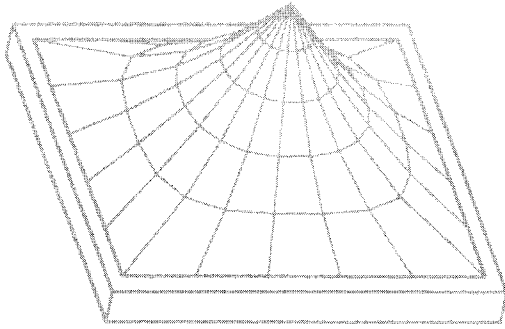
# THE TENSIONED FABRIC ROOF

Craig G. Huntington



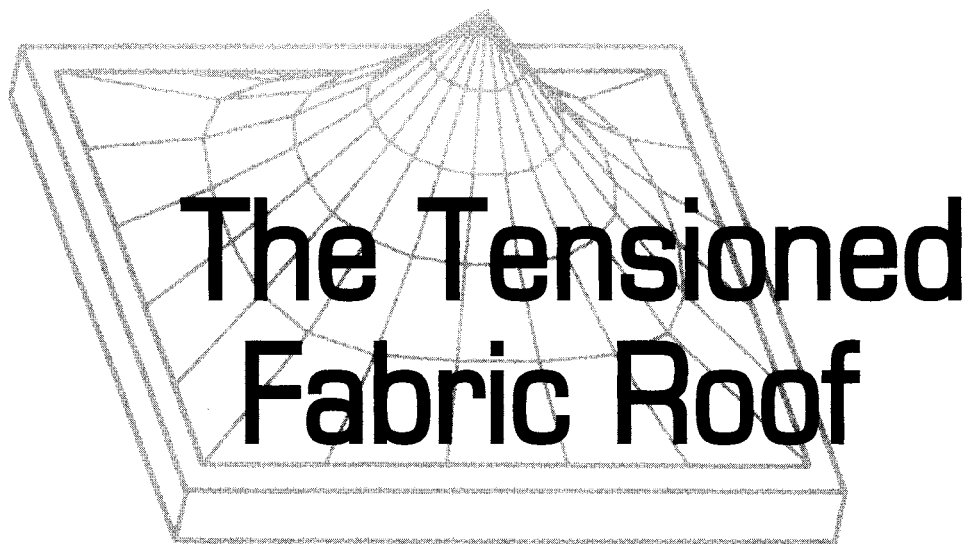
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*Library of Congress Cataloging-in-Publication Data*

Huntington, Craig G.

The tensioned fabric roof / Craig G. Huntington.

p. cm.

Includes bibliographical references and index.

ISBN 0-7844-0428-3

1. Roofs, Fabric—Design and construction. I. Title.

TH2449.H86 2003

695—dc22

2003068819

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Published by American Society of Civil Engineers

1801 Alexander Bell Drive

Reston, Virginia 20191

www.asce pubs.asce.org

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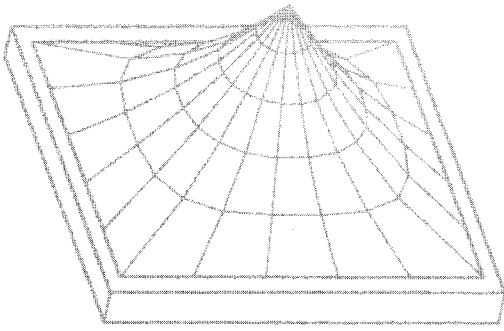
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Library of Congress Catalog Card No: 2003068819

ISBN 0-7844-0428-3

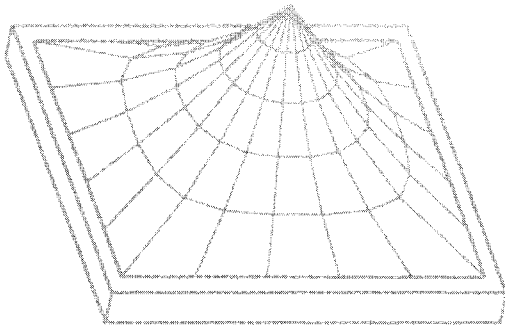
Manufactured in the United States of America.



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# Foreword

Craig Huntington is one of a handful of structural engineers in the United States qualified and experienced in the analysis and design of tensile membrane structures. These unique lightweight and free-flowing canopies represent, more than most other structures, the merger of architectural form and engineering principles. In writing this remarkable book, Mr. Huntington is fortunate to be able to call upon an undergraduate degree in architecture as well as a Master of Engineering from the University of California at Berkeley.

Except in really long-span structures, the structural system of a traditional commercial or institutional building may or may not be reflected in its form. It usually *is*, for reasons of logic and simplicity, but it is by no means an inherent requirement. In tensioned fabric roofs, the subject of this book, the membrane structure *is* the form!

As the author points out, these forms are almost always visually very attractive (some say seductive), and I feel certain that his education in architecture helped bring him to a career in tensile membrane design.

*The Tensioned Fabric Roof* is a wonderfully unique and complete work that fills a wide gap in the currently available literature on membrane structures. Prior to its publication, there were (and still are) basically three types of reference materials available to those interested in the subject matter. First, there are many promotional brochures and booklets being produced annually by material suppliers and fabricators. These show the physical attributes and properties of materials and provide many pictures of a great variety of finished works. Second, there are a few highly technical engineering textbooks that examine the complicated mathematics underlying the nonlinear behavior of large displacement flexible membranes. (These texts are so esoteric that even most practicing membrane specialists do not fully comprehend them!) Third, there is a consider-

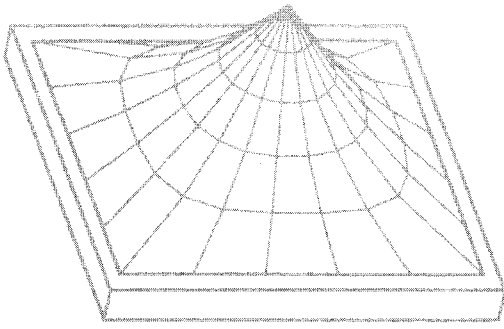
able number of what I refer to as “coffee-table” books. These expensive folio format books have beautiful pictures printed on thick glossy paper and do an admirable job of illustrating the wide range of forms that can be achieved and their spectacular architectural beauty. Recent books by Tony Robbin, Horst Berger, and Kazuo Ishii improve upon these pretty picture efforts by providing insights into the development, design approaches, and detailing technologies of these fascinating structures. But *The Tensioned Fabric Roof* is the first comprehensive publication in this area, and it will be highly useful to students, design professionals, constructors, and potential owner/users.

Craig Huntington was heavily involved in the production of a publication entitled *Tensioned Fabric Structures: A Practical Introduction*, published in 1996 by the American Society of Civil Engineers (ASCE). At the time, I was fortunate enough to be the Chair of the ASCE Special Structures Committee, which produced this document. I got to know Craig quite well and came to appreciate his considerable writing talents, a rarity for both architects and engineers. In the workings of the committee, the paucity of reference materials became very evident. I’m certain Craig’s service with this group influenced the direction of *The Tensioned Fabric Roof*.

Craig Huntington covers all the bases about this business, from basic shape descriptions and form-finding, through connection detailing, to fabrication and erection. In each case, he is careful to point out what is different about the design and construction of *these* structures as opposed to conventional “hard” systems. This is of great value to the novice architect or engineer just attempting to learn about tensile membrane design, a subject discussed in only a few schools of architecture or engineering. He draws upon his several years of tutelage in the firm Geiger Berger Associates (renowned in air-supported and tensile membrane design) and upon the resources of his own firm, Huntington Design Associates of Oakland, California. To illustrate principles and explain “how-to” procedures, he frequently utilizes projects from his firm, not out of professional egoism, but because these are designs with which he is logically most familiar. The reader will benefit greatly from this familiarity and from Craig’s years of experience with tensioned fabric.

For anyone wishing to get involved with the exciting field of tensile structural art/engineering, this book presents an ideal opportunity for launching such an experience. For the experienced practicing professional, it is an important and valuable addition to his or her library.

R.E. Shaeffer, P.E.  
*Professor of Architecture*  
*Florida A&M University*



# Preface

In 1978, as I neared the completion of my graduate studies in structural engineering at the University of California at Berkeley, I began compiling a stack of magazines that contained articles on what I considered to be the most interesting contemporary structural engineering work: long-span bridges, high-rise buildings, and stadiums. When the stack reached waist height, I began a list of the structural engineering consulting firms that had designed these structures, and with whom I might seek work. The job market for structural engineers was strong at the time, and I received offers from a top firm in Boston and Geiger Berger Associates of New York City, a young partnership that had already completed several innovative stadiums or arenas using what seemed at the time a highly improbable and exotic structural material: tensioned fabric.

Laying out the plusses and minuses of the two offers, the choice appeared easy. Among numerous advantages, I preferred the prospect of living in Boston to New York, and the Boston firm had offered significantly more money. Against all apparent reason, though, I selected Geiger Berger. It was as if I had no real choice in the matter, having already been seduced by the voluptuous forms of tensioned fabric.

My files still contain a copy of the November 10, 1977, *Engineering News Record*, the cover of which showed David Geiger and Horst Berger examining a dramatically curved stretched fabric model of a partially retractable bullfight arena roof. Other roofs may have been larger or more complex than the Geiger Berger roofs completed at that time, but there was a compelling beauty about the fabric roofs, an unsurpassed elegance in their economy of form and material that drew my eye inexorably. I date my love affair with the tensioned fabric roof from that time in 1978. It continues unabated to this day.