

## BOOK REVIEW

**Fibre Optic Methods for structural health monitoring**, by Branko Glisic and Daniele Inaudi, England, John Wiley & Sons Ltd, 2007, 262 pages, \$140.00, hardback, ISBN 978-0470-06142-8

Fiber Optic Methods for Structural Health Monitoring provides a good compilation of case studies for monitoring of various types of structures using long gauge type deformation sensors. It embodies the practical experiences of the authors for sensor configurations, and interpretation of results. This book serves as a good reference for the individuals contemplating or planning to conduct deformation based monitoring of structures. It targets the civil engineering audience and therefore, concentrates on the applications of long gauge sensors. In essence, the book does not bore the reader with detailed explanation of various optical fiber sensor types, sensor calibrations, real time monitoring, and sampling rates. Useful examples are made available throughout the book, and in particular they all concentrate on the practical applications of long gauge sensors in structures.

Chapter 1 presents an introduction to structural health monitoring. It provides elementary information about planning, benefits and measurement needs as well as coordination of activities to accomplish the objectives of the monitoring program. This chapter introduces topics in the general areas of monitoring strategies, installations, power and communication needs of sensing systems, and data management. These principles are accompanied by useful tables and flow charts. The chapter concludes with an example outlining the general principles involved in monitoring of structures.

The technological principles involved in sensing with optical fibers are discussed in Chapter 2. The authors try to keep a balance between details and brevity in presenting the principles involved in optical fiber sensing. While the book primarily focuses on long gauge interferometric sensors, it also provides information about the transduction mechanisms for some other types including Bragg gratings, Fabry-Perot, as well as Raman and Brillouin Scattering methods. Topics such as the effects of environment and the properties of the host material on the sensors,

mechanical bond, strain transfer mechanism, and transverse sensitivity of the optical fibers are discussed in the sensor packaging section of this chapter. This section also provides illustrative examples of the commercially available packaged sensors and their integration in structures. Examples include weldable sensors for steel members, packaged temperature sensors and long gauge sensors for reinforced concrete elements. The chapter concludes with a brief discussion on issues corresponding to the installation of permanent monitoring systems in the context of data acquisition, data management and software requirements.

Chapter 3 is the best chapter in this book. It provides comprehensive formulations for measurement principles involved in sensing of deformations with long gauge sensors. The formulations are generic and useful for other deformation based sensors as well. This chapter provides the reader with methods for interpretation of data acquired from long gauge sensors. The subjects covered include the interpretation of measurements in terms of the sensor gauge length, sensing in inhomogeneous materials, distributed sensing, interpretation of strain measurements, sources of errors, and interpretation of strain components from total strain measurements. The numerical example at the end of the chapter establishes the link between the field data, and qualitative interpretation of the structural response.

In Chapter 4 the authors introduce the subject of sensor topology for measurement of deformation components of interest. This chapter also serves as an introductory section for Chapter 5. The authors detail the procedures involved in monitoring the entire structure by subdividing it into a number of cells for instrumentation by a combination of the deformation sensors. The number and orientation of sensors in each cell is established based on the measurand component of interest, i.e. axial elements for tensile or compressive strains, and diagonal members for shear strains. The chapter concludes with field application examples using various sensor topologies.

The applications extend into Chapter 5 in which a direct analogy is made between the subdivision of the structure into a number of cells and finite elements

modeling for global measurements. This chapter provides the valuable experiences and insights of the authors for interpretation of field data. The analyses are qualitative and span over various types of structures including bridges, arches, tunnels, piles, and dams.

In a nutshell, this book is recommended as a good reference and source of valuable information for basic and applied principles in long gauge deformation sensing. It embodies the valuable field experiences of

the authors for sensor placement and interpretation of data. It is also written in a simple format and without very much of rigor for non-optical physics majors.

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