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Book review

Smart Technologies by K. Worden, W.A. Bullough and J. Haywood (Eds.), World Scientific, Singapore, 2003, pp. xi + 271, price £39, ISBN 981-02-4776-1

This book of 271 pp. is composed of 10 self-contained chapters which are focused on the main disciplines of smart technologies. The editors have been involved in a number of conferences on smart technologies and have invited some of the United Kingdom specialists in the field to prepare a chapter that provides an overview of fundamental concepts and recent advances in smart technologies. The multidisciplinary nature of the field is reflected by the different backgrounds of the authors and by the scientific approaches they have taken to present their subjects. The 10 chapters cover the following subjects:

1. Smart approach: an introduction to smart technologies.
2. Sensing systems for smart structures.
3. Vibration control using smart structures.
4. Data fusion: the role of signal processing for smart structures and systems.
5. Shape memory alloys.
6. Piezoelectric materials.
7. Magnetostriction.
8. Smart fluid machines.
9. Smart biomaterials.
10. Natural engineering.

Chapter 1 gives a general introduction of the subject and dwells on the fundamental concepts and definitions of smart technology and its interdisciplinary nature. Chapter 2 presents a comprehensive discussion of the sensing requirements and technologies. Particular emphasis is given to MEMS technology and piezoelectric transducers. Chapter 3 describes the application of smart structures in vibration control. The principal feedback control approaches using sensors and actuators embedded in structures are reviewed using practical examples. Chapter 4 introduces the general concepts that characterise data fusion. The various procedures for integrating large amounts of information are described first. The relevance of data fusion for smart structures is then discussed using practical examples. Chapter 5 is focused on the use of shape memory alloys in smart systems. A comprehensive review of shape memory alloys is first presented, which includes a description of the “memory” mechanism, a summary of the various types of memory alloys and their mechanical properties. Finally, a number of applications in smart structures are reviewed. Chapter 6 is directed to the use of piezoelectric materials in smart systems. The sensing

and actuation properties of piezoelectricity are first reviewed in a simple and intuitive approach. Several examples are then presented for the actuation and sensing functions. Chapter 7 considers the use of magnetostriction in smart structures. The physics of magnetostriction and the characteristics of magnetostrictive materials are first reviewed, then a few examples of applications are presented. Chapter 8 starts by giving the fundamental concepts and philosophy of smart fluid machines. It then focuses on the electrostructured fluids and finally presents a series of applications in valve systems to be used for smart systems. Chapter 9 discusses the subject of smart bio-materials. A survey of areas where bio-materials have, or could, provide a vital contribution to solve health or disability problems is first presented. A series of practical solutions that have been developed is then described with particular emphasis on the biological and medical issues. Finally, an interesting section on bio-materials for surgical implants is given which discusses the present and next generation of smart bio-materials. Chapter 10 introduces the concepts of intelligent biomimetics where the systems developed in nature to detect signals are studied in order to develop artificial devices.

Although the chapters have been written with different styles they all contain a good number of examples of actual structures, materials, devices and machines that have been designed and developed within the framework of smart technologies. All contributions are presented in a simple and non-mathematical approach. In my view, this book is particularly suited to scientists who are already involved in one sector of smart technologies and would like to broaden their knowledge or are willing to expand their activities to another field. Also, because of the simple approach used to introduce the various topics and the large number of examples presented it could be of great help for Masters or Ph.D. students who are beginning their projects in this field.

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