



# Wireless Sensor Networks: An Information Processing Approach

By Feng Zhao, Leonidas Guibas

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Information processing in sensor networks is a rapidly emerging area of computer science and electrical engineering research. Because of advances in micro-sensors, wireless networking and embedded processing, ad hoc networks of sensor are becoming increasingly available for commercial, military, and homeland security applications. Examples include monitoring (e.g., traffic, habitat, security), industrial sensing and diagnostics (e.g., factory, appliances), infrastructures (i.e., power grid, water distribution, waste disposal) and battle awareness (e.g., multi-target tracking). This book introduces practitioners to the fundamental issues and technology constraints concerning various aspects of sensor networks such as information organization, querying, routing, and self-organization using concrete examples and does so by using concrete examples from current research and implementation efforts.

- Written for practitioners, researchers, and students and relevant to all application areas, including environmental monitoring, industrial sensing and diagnostics, automotive and transportation, security and surveillance, military and battlefield uses, and large-scale infrastructural maintenance.
- Skillfully integrates the many disciplines at work in wireless sensor network design: signal processing and estimation, communication theory and protocols, distributed algorithms and databases, probabilistic reasoning, energy-aware computing, design methodologies, evaluation metrics, and more.
- Demonstrates how querying, data routing, and network self-organization can support high-level information-processing tasks.

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### **Editorial Review**

#### Review

Wireless sensor and actuator nets, also known as motes and smart dust, are an emerging computer class based on a new platform, networking structure, and interface that enable novel, low cost, high volume, applications. This text and reference is a critical link to create this new class by covering the field of study for both practitioners and researchers. Unlike earlier computer classes that have been mostly evolutionary, motes require the “tall, thin man” that Carver Mead used to describe custom VLSI design. Motes system research and development require, deep knowledge of radio links, networks, operating systems, each application, and their interaction. Zhao and Guibas provide an excellent foundation for embarking on understanding and building these new systems.

--Gordon Bell, Senior Researcher, Microsoft Corporation

This book provides both an insightful overview of the emerging field of wireless sensor networks, and an in depth treatment of algorithmic signal and information processing issues. An excellent text for both professionals and students!

--Deborah Estrin, Center for Embedded Networked Sensing, UCLA

#### From the Back Cover

Designing, implementing, and operating a wireless sensor network involves a wide range of disciplines and many application-specific constraints. To make sense of and take advantage of these systems, a holistic approach is needed and this is precisely what Wireless Sensor Networks delivers.

Inside, two eminent researchers review the diverse technologies and techniques that interact in today's wireless sensor networks. At every step, they are guided by the high-level information-processing tasks that determine how these networks are architected and administered. Zhao and Guibas begin with the canonical problem of localizing and tracking moving objects, then systematically examine the many fundamental sensor network issues that spring from it, including network discovery, service establishment, data routing and aggregation, query processing, programming models, and system organization. The understanding gained as a result how different layers support the needs of different applications, and how a wireless sensor network should be built to optimize performance and economy is sure to endure as individual component technologies come and go.

#### **Features:**

" Written for practitioners, researchers, and students and relevant to all application areas, including environmental monitoring, industrial sensing and diagnostics, automotive and transportation, security and surveillance, military and battlefield uses, and large-scale infrastructural maintenance.

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" Demonstrates how querying, data routing, and network self-organization can support high-level information-processing tasks.

#### **About the Authors:**

Feng Zhao is a senior researcher at Microsoft, where he manages the Networked Embedded Computing

Group. He received his Ph.D. in Electrical Engineering and Computer Science from MIT and has taught at at Stanford University and Ohio State University. Dr. Zhao was a principal scientist at Xerox PARC and directed PARC's sensor network research effort. He is serving as the Editor-In-Chief of ACM Transactions on Sensor Networks.

Professor Guibas heads the Geometric Computation group in the Computer Science Department of Stanford University, where he works on algorithms for sensing, modeling, reasoning about, rendering, and acting on the physical world. He is well-known for his work in computational geometry, computer graphics, and discrete algorithms. Professor Guibas obtained his Ph.D. from Stanford, has worked at PARC, MIT, and DEC/SRC, and was recently elected an ACM Fellow.

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