

Book Reviews

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Computing in Nonlinear Media and Automata Collectives. Institute of Physics Publishing (2001). ISBN 075030751X. £80.00. 403 pp. Hardbound.

The book is a fascinating guide for the discovery of the complex domain of 'unconventional computing'. The complexity arises from the fact that leaving the familiar paradigms of conventional computing requires a radical change of perspective and a multidisciplinary view. The introductory chapter makes this immediately clear. Unconventional computing is related to new computational paradigms (e.g. evolutionary computing and colony optimization), advanced architectures (e.g. cellular automata) and novel materials (e.g. DNA molecules and microtubules). A way of taking into account these three aspects is to consider computing in reaction-diffusion and excitable media as the reference 'technology'. Examples show how the new technology modifies the usual way of representing information, design computing architectures and finally, construct processors from natural components. In this way the reader discovers how 'natural' it is to think in terms of fully distributed computations, without any global state or global information, and to solve familiar problems from a completely different point of view. Using chemicals, waves and location to represent information, and the chemistry of reaction to represent computations, requires dealing with the notion of space as a first-class concept. Again, examples show how to see the spatial dimension in the solution of familiar problems, e.g. dealing with graphs up to communication networks. Every problem is solved by a specialized processor. The obvious question about the existence of a universal one is not only answered by an elegant construction, but also becomes the occasion to introduce different forms of universality and related unconventional technologies. As the author says, this is a training exercise in becoming prepared for the last difficult step: understanding how local behaviours determine the global one. This is achieved by studying the relationship between the dimension of the 'excitation intervals' of the excitable lattice and the reachability of states with different properties (uniform resting states, more or less predictable oscillations, and localized patterns of evolution). Various classifications are illustrated through examples of experiments. Again, theoretical results are meshed with methodological and architectural considerations.

The book can be read along different trajectories: the author proposes four of them. The richness of the topics allows for additional personalized readings satisfying the interests of multidisciplinary readers. The argumentation is well organized, from the basic concepts to more sophisticated techniques. However, a more careful structuring of the various levels of depth would make the fruition of the book easier for newcomers as well as experts in the field. Hence the book is a valuable support for research (among the others, it contains an impressive amount of

references that supports the historical reading of the involved disciplines), but it will be difficult to adopt as a support for education, unless it is advanced. This is a pity since the principles of unconventional computing should increasingly become part of the cultural background of interdisciplinary students and researchers.

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Small Memory Software—Patterns for Systems with Limited Memory. Addison-Wesley (2000). ISBN 0-201-59607-5. £29.95/\$44.99. 352 pp. Softbound.

In the last decade, mobile devices, smart cards, embedded systems and PDAs, are gaining in popularity because of their huge invasion of the market. One of the main limitations of these systems is their small main memory capacity, which is generally between 50k and 10Mb. Therefore a major concern in these systems is the optimal use of random access memory (RAM): such a concern is addressed in this book. The authors' basic purpose is to present a detailed survey of the techniques aimed to make clever use of the small amount of main memory generally available in commercial systems, such as those mentioned above.

The strategies are introduced as *patterns*, where a pattern is defined as 'the solution to a problem in a context'. The major techniques described in the book deal with the following topics: *Small Architecture*, describing the necessity of having each component of the system responsible for its own memory use; *Secondary Storage*, describing the conjunct use of RAM and disks' *Compression*; dealing with well-known strategies to compress data; *Small Data Structures*, aiming to define data structures and algorithms that work with small amounts of memory; and *Memory Allocation*, concerned with allocation and deallocation techniques. As the authors write, 'all the patterns in this book solve the same problem—too little memory—but they solve it in many different ways' and from different perspectives.

Each pattern is first overviewed, starting from the introduction of well-known concepts from operating systems, compression techniques and memory management. Then its possible implementations are discussed in further detail by describing in which particular commercial systems it is adopted.

Because of this two-level approach, I feel that this book is targeted at both those who simply want to know more about the specific techniques adopted to save memory in small memory systems, and those who have to design such systems. The interesting aspect of this book, however, is the relationship introduced between the patterns described—mainly well-known operating systems concepts—and the commercial systems where such strategies are employed.

The bottom line is that this book is well written and organized, and I feel that it fulfils its basic purpose of describing the major techniques adopted to optimize the use of RAM in systems with limited memory.

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