two important aspects of integration: one related to manufacturing activities and the other to computational functions. As a result, computational support for design, operation, control, planning and maintenance should be coherently integrated. In other words, knowledge-based symbolic reasoning systems should be effectively coupled with numerical packages, neural networks and graphical packages. Such coupling can be controlled at a meta-level of computing which manages the selection, co-ordination, operation and communication of the separate systems.

The second chapter presents a meta-level control architecture for a manufacturing IDIS. The meta-level sub-system has the following functions: coordination of various types of computation, distribution of knowledge into separate sub-systems, interface management between the sub-systems, resolution of conflicts among the systems, management of possible parallel processing, and the management of communication with the outside physical world such as sensors and actuators.

One particular implementation of the meta-system in an object-oriented style is presented in chapter 3. The choice of such an implementation paradigm is perhaps quite natural given the nature of the domain. Production rules, frame-based and method-based knowledge representation and inference are supported. Control of the different types of inference functions is also implemented. However, it appears from chapters 2 and 3 that the content of meta-level control knowledge depends on specific application domains as well as how domain knowledge is organized and distributed into separate computational sub-systems. In other words, the book fails to present a body of reasonably generic control knowledge that can be applied to more than one manufacturing domain.

Chapters 4 and 5 present systems for two individual aspects of manufacturing: conceptual design of mechanical parts and simulation. However, why the systems are "distributed" and "integrated" is not clear, as they only deal with individual aspects of manufacturing and there is no apparent distribution of knowledge in the systems. The system presented in chapter 6 for gear design, manufacturing and testing is a much better example of IDIS as defined in chapter 1. Chapters 7 and 8 again describe separate, individual systems for two different, unrelated applications, i.e. process start-up automation and operation support for chemical pulping. Apart from the fact that qualitative symbolic knowledge and quantitative algorithmic knowledge for the individual application domains are separated, neither of the systems is a typical example of IDIS.

The book assumes that all the sub-systems are under the control of a meta-level system, and it does not explain how to co-ordinate loosely-coupled or completely autonomous systems.

On the whole, the book gives a clear and convincing definition of integrated distributed intelligent systems for manufacturing. Unfortunately, a consistent example of such a system is not given throughout the book. Although it presents individual intelligent systems for different applications, it fails to explain the integration and distribution aspects in detail. It would be more desirable to use one consistent application example, only briefly explain the individual sub-systems of an IDIS for the application, and elaborate in detail on the distribution, integration and control of the sub-systems at the meta-level. A conclusions chapter at the end of the book would also have been useful.

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**Essays on law and artificial intelligence** by Richard Susskind, Complex 7/93, Norwegian Research Centre for Computers and Law, Tano, Oslo, 1993, pp 107, ISBN 82-518-3210-1.

One of the things that makes the domain of law so interesting as a place to investigate the use of knowledge-based systems techniques is that there is a considerable body of legal theory—jurisprudence—which articulates the nature of the law and legal reasoning. This means that there is

a critical issue as to how this body of legal theory can, and should, relate to knowledge based systems practice. This is still very much an area for debate: it was much discussed at this year's 4th National Conference on AI and Law held at Exeter, and is to form the topic of JURIX 94 (the Dutch conference on KBS and Law) to be held in Amsterdam this December.

Richard Susskind is a well known figure in AI and Law, having published two important books, *Expert Systems in Law* (Susskind, 1986) and *Latent Damage Law—The Expert System* (Capper and Susskind, 1988). He is particularly well placed to comment on the relationship between KBS and legal theory, since he is a legally trained person who has worked extensively on KBS, first in an academic setting and then in a practical situation. He has a great deal of sympathy for and understanding of KBS as applied to law, not always found amongst jurisprudes. This book reprints four of his shorter pieces published in journals and at conferences. One of the papers was originally published in 1986, the other three all in 1989. Additionally, there is a brief introduction to the collection.

The first paper was first published in *Modern Law Review*, and was written at about the same time that he was writing (Susskind, 1986). Essentially, it is a summary of the findings of that book, directed at lawyers, and explaining the new technology to them. Inevitably, it is now rather dated, and much has happened in the field in the last nine years that would need to be discussed were it being written today.

The second paper, originally published in *AI and Society*, discusses the distinctions between purist and pragmatic approaches to building knowledge based systems in the legal domain. The distinction is intended to apply both to AI and to jurisprudence, and any combination of purism and pragmatism with respect to the two disciplines are possible. The merit of the distinction is that it can help to avoid some sterile debates where an approach is criticized for not fulfilling aims that it never intended to satisfy. It remains relevant today, since there are still people who are inclined to castigate particular systems for not conforming to some jurisprudential conception of what a system should be. Susskind views himself as a jurisprudential purist and an AI pragmatist, but recognizes the possibility of contributions for others with different dispositions.

The third paper, which was presented at the Second International Conference on AI and Law, discusses the Latent Damage Advisor system, and examines the effects on the system of the jurisprudential stance developed by Susskind in his earlier work. Today this is perhaps the most interesting of the papers, since it explicitly discusses the relationship of legal theory to legal knowledge-based systems identified as an important issue in the opening paragraph of this review, and to which Susskind's experience is highly relevant. Of particular interest is the identification of aspects of building the system where jurisprudence did and did not help.

The final paper appeard in *Amongst Friends in Computers and Law*, and attempts to give an overview of KBS and law work in Europe. Inevitably, this is now very out of date, and so largely of historical interest.

As with any collection of old papers relating to a rapidly changing field, much of the material in this book needs to be seen in the light of developments that could only have at best been partially envisaged by the author at the time of writing. The middle two papers can, however, still be profitably read (or re-read) by those working in the field. The major disappointment of the book is that Susskind says it represents ten years of work in the field—but five of those have passed since the last paper was written. It would have been more valuable to have his more up to date reflections on the field, of which the seven page introduction offers no more than a glimpse.

## References

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