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Book reviews

Artificial intelligence in engineering: Tools and techniques reviewed by Dr Hayat Zerkani, Chemical Engineering Department, University of Technology, Loughborough, UK.
Knowledge representation: An AI perspective reviewed by Simon Parsons, Department of Electronic Engineering, Queen Mary and Westfield College, Mile End Road, London, UK.
Inheritance hierarchies in knowledge representation and programming languages reviewed by Andrzej Glowinski, Advanced Computation Laboratory, Imperial Cancer Research Fund, London, UK.

Artificial intelligence in engineering: Tools and techniques edited by D Sriram and RA Adey

Reviewed by: Dr Hayat Zerkani, Chemical Engineering Department, University of Technology, Loughborough, UK.

This book presents 25 selected papers from the Second International Conference on Applications of Artificial Intelligence in Engineering Problems (August 1987).

The collection highlights the importance of heuristics, knowledge and reasoning in engineering. It is especially good when discussing knowledge representation and acquisition, and would provide state-of-the-art examples surveying AI and expert systems in engineering.

The themes considered span from knowledge representation through knowledge acquisition to intelligent user-machine interfacing, applied to areas such as electronics engineering, control, avionics, robotics, etc.

The following highlights a number of papers which present interesting concepts and applications.

Lange's leading paper examines the use of exception hierarchies whose purpose is to provide a mechanism to represent broad general rules that can be qualified later by possible exceptions. An application related to railroad maintenance using the CRITIC expert system shell is then described.

The second paper describes an application that estimates construction project costs. The authors introduce a new type of inference system called Variable Precision Logic that is capable of reasoning with uncomplete and uncertain data within a specified time limit (scheme based on Dempster–Shafer theory). This mechanism is later applied to cost estimation of control systems for heating, ventilating and air-conditioning equipment in buildings.

'APES: Artificial Intelligence and Pragmatism in Software Development' explores the benefits and drawbacks of using expert system technology in the CAD field. The authors argue about the limitations of rule-based systems, and the integration of AI techniques and conventional programming for their application.

There are three papers which contain valuable information for readers interested in building intelligent front-ends. Chan and Holtzel's paper addresses the problem of the intensive task involved in specifying data input for the description of 3D objects in computer-based geometric modelling, and Balachandran and Gero's paper illustrates how AI techniques can be used to aid in recognizing graphic structural descriptions. The authors examine the role of interactive graphics in current engineering practice, and the role of knowledge in graphical interfaces. The excellent final paper on this topic highlights the limitations of existing user interfaces, presents a scope for improvement by examining the idea of intelligent front-ends more closely, and by identifying the objectives and required functionality of an ideal system.

On the topic of planning, 'Regarding placement as a consistent labeling problem with classification of constraints into abstraction levels' describes the cell placement problem in the design of

VLSI chips, and 'LEXMEA: Learning Expert System Model for Engineering Applications' discusses the issues of planning (also in VLSI circuit design), and the mechanism of learning by tuning and incremental refinements using three different learning paradigms.

The philosophy of decision-making in the human world and the general principles for building expert systems which operate on knowledge that is purely human is presented in 'A framework to build expert systems for decision support'. The acquisition of knowledge has always been the bottleneck for knowledge engineers and crucial in expert system construction. In this context, Chiang and Brown's paper discusses the automation of the knowledge acquisition process by presenting a prototype system called DSPL Acquirer.

The remaining papers address the topic of AI application in aerodynamic simulation, database management, diagnosis, communication systems, and robotics.

In summary, Sriram and Adey have provided a readable and well thought-out collection. However, the book lacks in organization. The collection could have been ordered according to the type of applications or AI topic. An index would have been very useful.

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Knowledge representation: An AI perspective by Han Reichgelt

It is a great and unusual joy to find a book on any subject that may be as fervently and wholeheartedly recommended as Han Reichgelt's text on knowledge representation. Despite the rather discouraging spelling mistake on the cover (for all their punchy name Thomas Phon Graphics managed to misread the contents page and write 'semantics networks'), this is an excellent introductory text both for graduate and undergraduate students taking a basic course in knowledge engineering, as well as AI researchers who want to know something about a vastly important topic.

The book is beautifully clear as a result of both the straightforward language used, and the avoidance of unecessary mathematical notation. Mr Reichgelt would rather call a spade a spade than 'a tool used for digging or cutting the ground', and would rather write 'p implies q' than $p \supset q$, except when absolutely necessary. This alone makes the book worth reading; proof that complex scientific ideas can be conveyed in the kind of words Orwell advocated in his *Politics and the English Language*, a work which should be on the required reading list of everyone who has to write. This is true even of the section on non-monotonic logics, a subject that usually causes even the most articulate authors to retreat behind a dense barrage of complex notation. Indeed, the description of circumscription is the clearest that I have come across, and contains nothing more complex than the symbols for conjunction and implication. Of course, there is a price to be paid for such clarity, and that is the sacrifice of a complete mathamatical description of each technique in its most intimate detail. In my view, however, this is not a problem. If you want to know the formulae for determining the minimal models of the predicate circumscription of a theory, they you follow up the original paper, which is given in the bibliography. If not, and I believe the bast bulk of the readers of this book do not need or wish to know such things, you can pass on to more urgent matters, such as acquiring a basic idea of the differences between production rule systems and semantic networks.

Although I am not the best judge given my limited knowledge of the subject matter, the text seems to cover a respectable breadth of material. For someone who has built a career out of logic, Reichgelt is unbiased in his account of first order predicate logic, giving it no more credit than any other formalism, and no more space it deserves. Indeed, he even apologises, unecessarily, for making the chapter on logic longer than others on the grounds that it introduces certain general concepts, and overall he is extremely even-handed. One chapter each is allocated to logic, production rule systems, semantic networks, frame-based representation languages, mixed representation formalisms, and parallel distributed processing, and they are all discussed with the