Artificial Intelligence for Engineering Design, Analysis and Manufacturing (1995), *9*, 245-246. Printed in the USA.

GUEST EDITORIAL

Special Issue: Conflict management in design

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Most design tasks involve the management of conflict. Conflict arises when contradictory requirements are imposed upon characteristics of artifacts, upon the process of their creation and/or upon their intended use. Even individual design requires trade-offs because of competing design criteria, such as functionality, safety, cost, and social acceptance. The ability of designers to avoid or minimize conflict through judicious tradeoffs, careful negotiations and other methods become their most valuable skills.

Resolution and detection of conflicts are especially difficult when the design task as well as knowledge concerning such competing factors are distributed among different actors with different perspectives. Therefore, conflict management is a central issue for problems and technical approaches related to cooperative design.

This special issue of *AI EDAM* contains nine articles with authors from five countries. The papers in this issue reflect a wide range of activities in the area of conflict management. These papers demonstrate that there is much high quality research, and that there are also interesting results from work in progress. This second group of papers was judged to form a useful contribution since one aim of this issue is to record current progress.

The first paper, "Conflict management in an interdisciplinary design environment" by Oh and Sharpe, contains a good literature survey and an interesting discussion of sources of conflict. A design environment that includes mechanisms for supporting recognition and resolution of conflicts is presented. This environment includes knowledge bases, documentation, and bond graphs to help in the integration of heterogeneous sources of knowledge.

The next paper, "Conflict management as part of an integrated exception handling approach" by Klein, treats conflicts as a type of process exception. Improvements over more traditional methods are achieved through integrating work-flow, rationale and conflict management processes. This enables three independent aspects of design, agents, time, and perspectives to be considered comprehensively.

The paper entitled "Using Pareto optimality to coordinate distributed agents" by Petrie et al., uses a model of design called REDUX with the concept of Pareto optimality in order to interpret parameters associated with dependency-directed backtracking. In this way, measures for treating conflicts caused by multiple objectives are supported. This also leads to the identification of opportunities for improving designs, version control, and support for delayed resolution of conflicts. Furthermore, thrashing during backtracking is avoided.

Kuokka and Harada's paper, "Communication infrastructure for concurrent engineering," describes the communication processes used in SHADE for integration of heterogeneous software systems within the scope of the SHADE (shared dependency engineering) project. The authors maintain that conflict management is successful when information between these systems is transferred efficiently. A matchmaking paradigm is employed to locate all relevant players and constraints while other processes assist user interaction.

"Using Single Function Agents to investigate conflict" by Dunskus et al., is a paper that is based on the premise that design systems can be built by composing many small, single-function agents. Agents are specified by the attributes "Target," "Point of view," and "Function." This restricts their knowledge and action, allowing a rich set of precise conflicts and associated resolutions to be categorized and described. A platform called SINE helps build multi-agent systems that handle conflict resolution through negotiation.

In "Management of conflict for preliminary engineering design tasks" by Haroud et al., a knowledge representation which includes two types of assumptions is used in an approach to constraint-based design. A nonmonotonic constraint activation system employs three generic con-

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flict management strategies which are explicitly linked to the types of constraints involved. In a system that is destined to be interactive, three specialized strategies are introduced in order to improve conflict management involving preferences.

The paper entitled "Mixed quantitative/qualitative method for evaluating compromise solutions to conflicts in collaborative design" by Bahler et al., builds upon several years' work in constraint-based design. Utility theory is used to mediate negotiation involving a wider range of constraint types than was possible in previous proposals. Furthermore, parameters having partially ordered domains are allowed and no issue has priority over any other.

In "Conflict management in knowledge acquisition" by Dieng, a conflict management approach is proposed in a knowledge acquisition tool for multiple experts called KATEMES. This approach includes a method for conflict detection for knowledge modelled according to the KADS methodology. In addition, the paper includes a method for conflict detection and resolution that is based on comparison of knowledge graphs. This method is illustrated by examples in traffic accident analysis.

"Modelling conflict management in design: An explicit approach" by Brazier et al., is a paper that proposes a model of how conflicts arise in design. An explicit meta-representation is proposed to detect several types of conflicts during design tasks and this leads to rational analysis methods and several conflict management strategies. Many examples help to illustrate their proposals.

Of course, there is still much work to be done beyond the papers just described, particularly in areas of consistency checks, complexity analysis and use of game theories in agent negotiation schemas. The drawing together of the current work in this special issue should serve as a "springboard" for further endeavors in the area of conflict management. In the meantime, the editor would like to thank the reviewers whose work in providing constructive suggestions improved the quality of the papers in this issue. Reviewers for this issue were Dennis Bahler, John Boardman, Frances Brazier, Dave Brown, Olivier Corby, Mark Gross, Mark Klein, Dan Kuokka, Vincent Oh, Charles Petrie, Rich Quadrel, Bill Robinson, Andreas Scherer, Don Schwartz, John Sillince, Sanjai Tiwari, Paul-Andre Tourtier, and Jan Treur.