

Intelligent Agent Support in Engineering Design

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Abstract

Concurrent engineering draws together team working and cooperation, with the aim of reducing the need for costly design modifications in the later stages of design and product development. However, the complexities arising in the process of design, in general, defy formal analysis and computational support is required. In providing intelligent computational support for concurrent engineering a combination of various problem solving strategies may be required for complex design situations. It is proposed that an appropriate model for such provision is in the form of a set of interacting autonomous intelligent agents, possessing different problem solving capabilities and differing degrees of intelligence. The requirements for such agent-based design support are discussed and possibilities for its realisation, in a distributed cooperative design environment are explored.

In complex design situations, a teamwork approach is necessary to reduce design and development times and to reduce overall costs. This is an important basis for the concurrent engineering approach, which aims to reduce the need for costly modifications to a design in its later stages and to avoid conflicts in the later design stages through early consideration of the relevant issues, thus enabling a higher degree of conflict anticipation than is the case with the more traditional sequential design process.

For all but the simplest of projects the process of design is undertaken by a group or groups of heterogeneous designers. Each of these individuals or groups will normally work on distinct (but sometimes overlapping) parts of the overall design, and will operate from different perspectives. Effective communications and accessibility to design data and standards, past records and documented design histories are very important. The problem is particularly acute in the case of a distributed design team; for cohesion and efficient operation much reliance needs to be placed on computational design support.

In this paper an agent-based approach to concurrent engineering design support is advocated. After outlining a few issues relating to intelligent computational systems support for design in general, the particular features of multi-agent systems are discussed. The essential requirements of an agent-supported design environment are identified, and proposals for an agent-based system are presented. After considering the communication needs for distributed agent-based support, the paper concludes by reporting on the results of research which provides some of the components for agent-based design support.

Keywords: intelligent agents, engineering design, hybrid AI systems, concurrent engineering, co-operative design