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Alain-Jérôme Fougères, Egon Ostrosi

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Intelligent agents for feature modelling in computer aided design

Alain-Jérôme Fougères[a], Egon Ostrosi[b]

[a]ECAM Rennes – Louis de Broglie, Campus de Ker Lann, Bruz, 35091 Rennes, France

[b]UBFC – Université de Bourgogne Franche-Comté, UTBM, 90010 Belfort, France

ABSTRACT

CAD modelling can be referred to as the process of generating an integrated multiple view model as a representation of multiple views of engineering design. In many situations, a change in the model of one view may conflict with the models of other views. In such situations, the model of some views needs to be adapted in order to make all models consistent. Thus, CAD models should be capable of adapting themselves to new situations. Recently, agent based technologies have been considered in order to increase both knowledge level and intelligence of real and virtual objects. The contribution of this paper consists in introducing the intelligent agents in intelligent CAD modelling. The proposed agents are elementary geometrical and topological objects. They incorporate the functions of observation, decision and action, and possess their own knowledge. Agents have the capacity of communication and inference based on the feature grammars. They are modelled as bio-dynamic objects that enjoy the properties of fusion, division and multiplication. Being aware of the context, the proposed agents interact to form potential regional transitory communities, called regions. Being aware of their belonging in a region, agents interact by generating virtual links (virtual extensions). These virtual links produce: (a) fusion of agents, (b) division of agents and c) multiplication of agents. The emerged agents interact with the other agents in a region to recognize each other and to form specific sub-communities, called intelligent features. From a CAD software development point of view, this paper advocates the idea of a new phase of CAD system development based on the agent-oriented programming (*AOP*) paradigm.

KEYWORDS

CAD modelling, intelligent features, feature recognition, geometric knowledge, intelligent agents, emerged agent.

1. INTRODUCTION

CAD modelling is an essential part of engineering design activity. Building CAD models is not a simple problem for engineers. CAD modelling involves abstraction, simplification, and formalisation under some assumptions. It can be referred to as the process of generating an integrated multiple view model as a representation of multiple views of engineering design. A view contains a model that represents only those aspects of the product, or a part, that are relevant for the corresponding phase [1]. In many situations, a change in the model of one view may conflict with the models of other views. In such situations, the model of some views needs to be adapted in order to make all models consistent. Thus, CAD models should be capable of adapting themselves to new situations, which is one of their important characteristics. Today's CAD models do not possess the adaptive capability that is an important characteristic of intelligent behaviour.

Adaptive CAD models are much more likely to emerge if they are composed of elements whose existence, by itself, enhances the probability of success and survival during changes and modifications. Likewise, these complex adaptive models themselves are more likely to survive if they can self-sustain. Self-sustaining is the long-term ability of a CAD design model to reproduce. Therefore, the CAD modelling product, or part, can be self-sustaining, which is another important characteristic. How these CAD intelligent models need to be designed so that they are self-sustaining, self-supporting and suited for integration is an important subject of research on emergent behaviour [2]. The concept of intelligent behaviour in CAD models was not supported by a concrete industrial need and its development was hindered by the insufficient maturity of theoretical fundamentals and technological resources [3]. However, recently, cloud-based design and manufacturing (*CBDM*) has emerged as a