

Pro-active Environment for Assisted Model Composition

Sascha Opletal, Emil Stoyanov, and Dieter Roller

Institute of Computer-Aided Product Development Systems
University of Stuttgart
{opletal,stoyanov,roller}@informatik.uni-stuttgart.de

Abstract. Automatic testing and learning methods are of great benefit in many engineering areas. They provide the possibility for training without the need of personal communication and eliminate related barriers that hold up project progress. As most technical systems include components that are related to each other and need to form a properly working system, a knowledge base which allows to retrieve the relations of a component to others regarding its properties and targeted functionality can support this task in many ways. Our system for assisted model composition forms a highly structured documentation system, based on model semantics. An important aspect of our system is the combination of user activated information retrieval and pro-active model composition assistance. The model semantics define specialized dependency annotations that can be attached to selected parts of the model, and with the help of which relevant guidelines for related processes, such as model couplings, and belonging remarks about materials, integration oddities, exceptions and other dynamically defined properties, can be brought to the designer's attention.

Keywords: Knowledge Management, Cooperative Learning, Error-Reduced CAD.

1 Introduction

Whenever a new component is designed, it has to meet certain requirements and constraints such as quality, cost and fitness for the intended purpose. The task is to find the optimal ratio between all those factors in order to succeed on the market. A large set of technical requirements and product specifications determine the projects technical characteristics which the designer has to consider when working on particular elements.

The product development as a whole is highly dependent on how well participating parties handle these requirements, the speed of the development and re-usage of accumulated experience and knowledge [2].

This work presents a system that addresses effective re-usage of accumulated designer experience in a collaborative manner and as a result improves speed of development while being able to follow project specifications. The described system is implemented on top of a semantic network, which in itself acts as a foundation to store and semantically link knowledge.

1.1 Knowledge

The concept of knowledge is not easy to grasp and is still open to philosophical debate, as a few exemplary definitions show:

"Information combined with experience, context, interpretation, and reflection. It is a high-value form of information that is ready to apply to decisions and actions." T. Davenport et al., 1998

"Explicit or codified knowledge refers to knowledge that is transmittable in formal, systematic language. On the other hand, tacit knowledge has a personal quality, which makes it hard to formalize and communicate." I. Nonaka, 1994

A tacit knowledge is one that exists purely in the mind of people, while explicit knowledge is communicated through the exchange of modeled information in the collaborative environment. A key to a more efficient work flow is to include the tacit knowledge into the design process as much as possible and make it available as expertise on a problem domain. A system can only access the knowledge that is modeled and captured. This process can be assisted through special developed tools that can catch semantics and intentions of the users and links to where the expertise can be found. This leads to two major aspects that we need to cover with our semantic expertise sharing and acquisition environment:

- Methods for description of expertise such as conflicts, solutions, workarounds, etc.
- Enabling pro-active assistance for the distribution of knowledge

Currently, by no means, shared documentation is used for rapid learning rather than spending resources and time on absorbing the documentation individually. An expertise sharing would support rapid learning with the ability of the designer tools to extract knowledge automatically in the development process, as well assist for its proper import to the knowledge base system.

The used active semantic network (ASN) [7][9] implements a knowledge-representation technique that allows for modeling of complex geometric entities, team organization, document flow and processes in the product development model. These information entities are linked by semantic relations which provide as well a means to organize information as well as to establish connections between relevant information types and augment the information beyond the actual content.

1.2 Proactive Assistance

The process of design requires the designers to be aware of a large number of parameters related to the project specification, techniques of composition, design practices, conflict resolution, etc., with knowledge-base approaches described briefly in section 1.1 that address aspects like semantic representation and retrieval. However, this information has to be retrieved in the appropriate moment, considering the designer's role, current task and progression to deliver meaningful and helpful information that can be consumed immediately. Traditional ways of information retrieval assume that the designer himself searches for documentation on demand,