Chapter 3
Coordinated and Recorded Human Interactions for Enhanced Intelligence in Product Model

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Abstract. Product definition on the basis of STEP IPIM, ISO 10303 product model standard grounded a new technology in engineering. One of the main trends in product modeling is improving communication between human and modeling procedure by including intelligent computing methods both in modeling procedures and model descriptions. This is a great challenge because definition of product objects must be transparent for engineers at any time in an industrial engineering process. In this chapter, the authors introduce one of their contributions in knowledge assisted intelligent control of engineering object definition at product model based engineering activities. The proposed modeling is devoted as an extension to currently prevailing product modeling in leading product life cycle management systems. Chapter starts with an introduction to the proposed modeling by its preliminaries in work of the authors and others. As the main contribution, transferring knowledge from the human product definition process to the product model, method for better communication at object definition, new content definition for engineering objects, and multilevel structure in order to facilitate implementation are discussed. In the main methodology of the proposed modeling contextual human intent, engineering object, and decision entities are applied in the form of spaces extending the conventional model space in product models.

3.1 Introduction

Engineering has been changed by the introduction of powerful and efficient product modeling that produced highly integrated product descriptions utilizing recent...
achievements in informatics and its technology. On the road to recent product life-cycle management (PLM) systems milestones were among others partial solutions in CAD/CAM, CAE and other systems, the STEP IPIM (Standard for the Exchange of Product Model Data, Integrated Product Information Model) ISO 10303 product model standard, and the ISO STEP FFIM (Form Feature Information Model) for form feature definition.

By now, including intelligence in the product definition practice is a reality. One of the main trends in product modeling is including intelligent computing at object definition methods both in modeling procedures and model descriptions. The main objective is improving communication between human and modeling procedure. Despite numerous approaches in the literature, it is hard to define that what the purpose of intelligence is in engineering systems. Intelligence in product model is urged by virtual prototyping for product evaluation at the extending virtual stage of product development. Other challenges such as flexible configuration of product, well-engineered construction, handling frequent product changes, and engineering for short innovation cycles stimulate need for intelligent product definition.

Achievements in product modeling established a new technology in engineering where highly integrated object model serves engineering activities for the life cycle of a product. The authors of this chapter analyzed the latest product modeling technology and recognized several new characteristics. Starting from these recognitions, they developed a methodology for knowledge transfer from human to product model. Concept of this methodology is producing a contribution to currently prevailing product modeling and industrial product PLM systems.

Integration of all embedded mechanical, electrical, electronic, hardware, and software subsystems of products in a single model caused a demand for the application of different engineering disciplines at the same modeling process. Advanced product modeling, life cycle management of product information, connection of this virtual world with a related physical world, and advanced simulations constitute a new environment that is ready to accept intelligent engineering methods.

Communication between two engineers is outlined in Fig. 3.1. Engineer A is an authorized and responsible human interacting product object handling processes in order to define product objects according to own intent. Object handling processes together with knowledge support processes create and modify objects in product model for life cycle engineering. These processes apply approved knowledge sources. Authorized and responsible human Engineer B understands product object definitions by Engineer A. Work of Engineer B includes relating new objects to objects defined by Engineer A and sometimes modification of those objects according to changed circumstances. For this purpose, Engineer B applies knowledge about intent and thinking process on the objects defined by Engineer A. Consequently, product model must serve as an advanced medium for the communication between engineers.