Editorial

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Jivka Ovtcharova was awarded an Engineering Diploma from Moscow Power Institute in 1982, a Doctorate in Mechanical Engineering from the Technical University of Sofia in 1992, and a Doctorate in Computer Sciences from the Technical University of Darmstadt, in 1996. She has previously worked in the Central Laboratory of Automation and Scientific Instrumentation of the Bulgarian Academy of Sciences, the Fraunhofer Institute for Computer Graphics in Darmstadt, Tecmath AG in Kaiserslautern, and Adam Opel AG in Rüsselsheim. She is currently Head of Institute for Information Management in Engineering at the University of Karlsruhe and Director and Board Member of the Research Centre for Information Technologies of Karlsruhe. She is also Equal Opportunities Commissioner of the University of Karlsruhe.

The competition level implied by globalisation forces companies to act faster and more efficiently when innovating their products. Market success is closely related not only to product performance and user friendliness, but also to timeliness delivering of innovations.

Computer-Aided Innovation (CAI) is a young domain in the array of CAX technologies. Its rising importance is substantiated through the growing demand for it in higher industry. The goal of CAI is to support enterprises throughout the innovation process. Innovation goes beyond the process of a (technical) invention. Innovations arise from the implementation and application of inventions. Inventions encompass the phases from finding new ideas to the build-up of prototypes, while innovation management is the systematic planning, support and control of ideas in an organisation that aims at the application of ideas and their implementation in the market.

A comprehensive vision conceives CAI systems beginning at the creative stage of perceiving business opportunities and customer demands, going through developing inventions, and up to the point of turning inventions into successful innovations in the market.

Innovation includes the following dimensions:

- Product innovation, which involves the introduction of a new good or service that is substantially improved. This might include improvements in functional characteristics, technical abilities, ease of use, or any other dimension. It is common for companies to highlight in their public documentation and marketing the innovative aspects of their products.
- Process innovation involves the implementation of a new or significantly improved production or delivery method.
- Marketing innovation is the development of new marketing methods with improvement in product design or packaging, product promotion or pricing.

- Organisational innovation (also referred to as social innovation) involves the creation of new organisations, business practices, and ways of running organisations or new organisational behaviour.
- Business model innovation involves changing the way that business is done in terms of capturing value, e.g., Compaq vs. Dell, hub and spoke airlines vs. Southwest.

As a result of the *1st IFIP Working Conference on Computer-Aided Innovation*, which took place in Ulm in November 2005 and of the CAI workshop celebrated in May 2006 in Karlsruhe, the following major trends and challenges for CAI are identified:

Integration

CAI needs to be integrated into the existing business process models of enterprises in order to gain control over the innovation process. As many enterprises work nowadays in a global network or represent a global network themselves, CAI is also confronted with the challenges to cross company and country borders (exchange of data, intercultural problems, product usability). Additionally, for the implementation of CAI processes, solutions have to be found for all dimensions of integration: methods, process, information and software.

Virtualisation

In the context of the efforts of enterprises to reduce the time-to-market, virtual engineering gains more and more importance. Virtual engineering deals with the early, continuous and networked (process viewpoint) and integrated (system viewpoint) support of the development process of interdisciplinary products with regard to coordination, evaluation and concretisation of the development results of all partners based on virtual prototypes. In this context, the methods and tools of CAI need to be integrated into the virtual engineering process.

Interdisciplinary cooperation

Nowadays, products are composed of parts from different engineering disciplines, such as mechanical parts, software components and electronic parts. In order to be able to develop such complex products, specialists from all involved disciplines need to work together. As a consequence, the different working worlds (languages, terms, methods, tools, processes) need to be integrated. This integration of different disciplines also has an influence upon the CAI process.

It is expected that changes in innovation paradigms will occur through the use of CAI methods and tools, which structure is partially inspired by the Theory of Inventive Problem Solving, known as TRIZ. TRIZ states that technical systems do not evolve at random but that they follow certain patterns, which are called patterns of evolution. One of these patterns declares that the evolution of technological systems follows a life-cycle of birth, growth, maturity, and decline, following the shape of S-curves that are influenced by the number and quality of the inventions related to the technological system. Recent studies show that market and enterprise evolution are also linked to the same kind of S-shaped development, and that differences in the stages of progress of technological systems, markets and enterprises mutually influence each other, resulting in complex relationships of the innovation process.

The emerging CAI technologies, together with other improved CAX technologies, will allow the study of the patterns of technological evolution based on current information technologies and methods, such as semantic web, data mining, text mining, theory of chaos and evolutionary algorithms, and will help in more accurately identifying the patterns and complex relationships that exist among the technological objects, services, processes and businesses for helping enterprises to reduce the risk of failure and to augment the likelihood of success in the implementation of innovations.