Analysis of Design Process Dynamics (extended abstract) [1]

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Providing automated support to manage the dynamics of a design process is in most cases not trivial. For example, in [3] some of the requirements put forward are that (1) a complete design process representation is needed, (2) with sufficient detail to allow for direct execution. Also by [1], [2] it is put forward that supporting the management of the dynamics of a design process is an important challenge to be addressed. This indeed is the aim of the current paper. The type of design considered is the design of component-based (e.g., software) systems for dynamic applications. In such application areas often components can be (re)used for which the properties are known. By composing a number of such components in a component-based design, the required overall dynamics is obtained. As holds for many design processes, designing component-based systems can be a rather complex and dynamic process, for which a number of tasks play a role, for example in this specific case:

1. maintaining of specifications of properties of (reusable) components
2. maintaining of requirements on the overall system to be designed (usually in close contact with a stakeholder)
3. refinement and revision of requirements
4. determination of reusable components based on their properties, to find a system that satisfies the requirements

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5. checking whether a system (a design object description) satisfies the requirements
6. revision of a design object description that does not satisfy the requirements

Most of these tasks essentially involve the dynamics of design as a process. The analysis of this *design process dynamics* is the subject of the current paper. In particular, the dynamics of a design process has been analysed in such a precise way that properties of the process as a whole can be specified and, moreover, part of the analysis contains enough detail to allow for simulation. The result of simulation has been checked against the properties of the design process as a whole.

Compared to the references mentioned above, the approach put forward is a declarative, logical approach supported by a formal language TTL for specification of dynamic properties of design processes, which has a high expressivity. Furthermore, also simulation models are specified in a declarative, logical manner, which allows using these specifications in logical analysis as well.

The paper shows the potential of this formal analysis as a technique for analysis at a high level of abstraction, and for constructing simulations at an abstract level to experiment with dynamics of a design process. The simulation actually is entailed by the analysis and requires no additional programming.

References

[1] Baldwin and Chung (1995). A Formal Approach to Managing Design Processes. IEEE Computer, Feb. 1995, pp. 54-63.

[2] Brown, D. C., and Chandrasekaran, B., (1989). *Design Problem Solving: Knowledge Structures and Control Strategies*, Pitman, London.

[3] Corkill, D.D. (2000). When Workflow Doesn't Work: Issues in managing dynamic processes, *Proceedings of the Design Project Support using Process Models Workshop*, Sixth International Conference on Artificial Intelligence in Design, Worcester, Massachusetts, June 2000, pp. 1-13.