DISCRETE EVENTS CELLULAR MODELS WITH EXPLICIT DELAYS

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Abstract

This work is devoted to introduce several formal descriptions used to model and simulate cell-shaped spaces. The paradigms are based on the DEVS and Cellular Automata formalisms, combined with transport delays and inertial delays. The specification formalisms have been defined for binary or three-states cell spaces, and have been extended to other domains. The delay concepts belong to the digital circuits domain, and have been adapted to the Cellular Automata paradigm, being one of the main contributions of the present work. The formalims allow the automatic definition for the cell spaces, easing the model verification, allowing the cost-effective development of simulators. A tool was built with the goal to implement the formalism, allowing to verify empirically the performance of the proposed solutions. Development times were considered, with special attention to the testing and mantainance costs. An abstract simulation mechanism was also proposed, with the goal to improve the execution times of the cell spaces based on the flattening of the hierarahical models. This approach allowed to improve the execution times up to one order of magnitude. It must be noticed that a model can be built automatically using its specification, easing the verification problems and allowing rapid development of the simulators. The use of a formal mechanism allowe to reduce the development times, due to the improvements obtained in the testing and maintainance phases. The use of this formal mechanism also allows automatic verification of the model structure, permitting the programmer to focus only in the development of the models to be implemented.

Keywords: Discrete Events simulation, Cellular Automata, Transport Delays, Inertial Delays, Modelling Methodologies, Object-Oriented simulation.