System Level Modelling and Performance Estimation of Embedded Systems

The advances seen in the semiconductor industry within the last decade have brought the possibility of integrating evermore functionality onto a single chip forming functionally highly advanced embedded systems. These integration possibilities also imply that as the design complexity increases, so does the design time and effort. This challenge is widely recognized throughout academia and the industry and in order to address this, novel frameworks and methods, which will automate design steps as well as raise the level of abstraction used to design systems, are being called upon. To support an efficient system level design methodology, a modelling framework for performance estimation and design space exploration at the system level is required. This thesis presents a novel component based modelling framework for system level modelling and performance estimation of embedded systems. The framework is simulation based and allows performance estimation to be carried out throughout all design phases ranging from early functional to cycle accurate and bit true descriptions of the system, modelling both hardware and software components in a unified way. Design space exploration and performance estimation is performed by having the framework produce detailed quantitative information about the system model under investigation. The project is part of the national Danish research project, Danish Network of Embedded Systems (DaNES), which is funded by the Danish National Advanced Technology Foundation. The project is carried out in collaboration with the Danish company and DaNES partner, Bang & Olufsen ICEpower. Bang & Olufsen ICEpower provides industrial case studies which will allow the proposed modelling framework to be exercised and assessed in terms of ease of use, production speed, accuracy and efficiency. The framework allows a given embedded system to be constructed and explored before a physical realization is present and it can be used in the design of completely new systems or for modification of legacy systems. The primary benefits of the framework are the possibilities of exploring a large number of candidate systems within a short time frame leading to better designs, easier design verification through an iterative refinement of the executable system description, and finally the possibility of a reduction of the time-to-market of the design and implementation of the system under consideration. In practice, however, additional time spent on software development in order to provide commercial quality tools supporting the method is required.

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