Embedded Tutorial I

The Four Aims of EDA Software

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Abstract

Development of EDA software is a moving target, there are four aims, towards which EDA software is developed: capacity & speed, modelling of effects, level of abstraction and ease of usage / shortening the response loop. Capacity and speed go along with Moore’s Law, all the devices of a design, number of which is doubling every 18 months, must be handled by EDA software at acceptable speed.

Today this is only achievable by massive parallelisation of the engines. Cadence introduced Tempus, Voltus, Quantus software, which are massively parallelised. Nanometer technologies and high-speed designs require modelling of new effects. Sigrity from Cadence provides simulation of temperature, electro-magnetic emission, IR-drop, current density, noise level and so on, on board level, which was not possible before with this level of accuracy. Transaction modelling (TLM) is a new level of abstraction for creating and verifying a design. By writing transaction models and using Cadence CtoSilicon software the designer can concentrate on optimal implementation of the algorithm and explore different design options.

Design flows usually contain loops, it is not possible for the implementer to get immediate feedback, if his decision was correct. Technologies like Virtuoso EAD, iPVS, LDE-simulation provide immediate feedback to implementer, so he can optimize the design and increase his productivity. Cadence became 4th largest IP provider. It offers numerous design IP and Verification IP blocks for different technology nodes. Recently Cadence acquired Tensilica, which offers configurable dataplane processor IP, which enables creation of highly optimized data-flow processors. Xtensa Processor Generator engine creates various models and files for hardware design, system modelling and software tools, which are tailored for the configured processor.
Embedded Tutorial II

Formal Methods for Emerging Technologies

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Abstract

Formal Methods advanced to an important core technology in Computer-Aided Design (CAD). Prominent examples include representations for Boolean functions such as Binary Decision Diagrams (BDDs) or solvers for satisfiability problems such as SAT- or SMT-solvers. They are heavily utilized not only in obvious application areas like verification but can also be exploited for other CAD-tasks including synthesis, optimization, test pattern generation, etc. This allowed for impressive improvements in the design for conventional circuit technologies. At the same time, mainly caused by the expected physical boundaries and cost restrictions of conventional CMOS-based circuitry, researchers and engineers also started the investigation of so-called emerging technologies such as:

* Quantum Computation, in which quantum-mechanical effects (e.g. superposition or entanglement) are exploited in order to represent multiple states at the same time and, thus, allow for massive parallelism.

* Reversible Computation, in which all operations are assumed to be bijective. This could be beneficial e.g. for certain low-power applications or the design of encoders/decoders. At the same time, reversible logic provides a basis for quantum computation.

* Optical Circuits, which rely on optical rather than electrical signals and allow for ultra-high-speed networks while having beneficial low-power properties.

* Digital Microfluidic Biochips, in which laboratory procedures in biochemistry and molecular biology are automated by providing a platform in which samples and corresponding operations can be controlled.

Although most of these technologies are still in a rather “academic” state, first physical realizations have already been presented. In case of digital microfluidic biochips, first solutions even entered the market recently. This motivates a more detailed consideration on how to design circuits for these technologies. As for conventional circuits, formal methods do play an important role here. In this tutorial, we are aiming for addressing the current momentum caused by the recent accomplishments in these areas by providing a comprehensive introduction into these emerging technologies as well as corresponding CAD-methods. This will include a special focus on how formal methods such as BDDs and SAT/SMT solvers may help in the design and verification of circuits for those technologies. By this, promising applications of established design techniques in entirely new fields are reviewed and discussed.