PROJECT PROFILE

2A717: Design refinement of embedded analogue and mixed-signal systems (Beyond Dreams)

EDA FOR SOC DESIGN AND DFM

Partners:

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Key project dates:

Start: October 2008
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Countries involved:

France
Germany
The Netherlands

There is a growing need for digital systems to interact directly with their analogue physical environment. More and more often, the digital elements of system-on-chip and system-in-package devices are tightly interwoven with analogue functions. This new category of device combines digital hardware with analogue and mixed-signal blocks such as radio frequency interfaces, power electronics, and sensors and actuators. The MEDEA+ Beyond Dreams project will provide chipmakers and system designers with a common system-level design environment for the modelling and simulation of embedded hardware/software and analogue/RF functionality to boost European competitiveness in the mixed-signal domain.

Embedded hardware/software systems are found in portable devices such as mobile phones, digital watches, MP3 players and personal digital assistants as well as integrated in large stationary installations for traffic lights, factory controllers and payment systems. Very small but highly complex devices are also being embedded in credit cards, e-passports, security tags and labels, and medical devices. The expectation is that more and more objects will be equipped with highly integrated embedded systems.

Until recently, the various elements of mixed analogue/digital systems have been considered as separate entities and their interfaces designed accordingly. Now embedded analogue and mixed-signal systems (EAMS) combining digital hardware/software with analogue/radio-frequency (RF) systems in system-on-chip (SoC) or system-in-package (SiP) environments has led to a new complexity. The common challenge in the development of EAMS is to cope with both the digital hardware/software system and its operating environment – such as network protocols, traffic, sensor and RF circuits.

The MEDEA+ 2A717 Beyond DREAMS project is developing methods for dealing with the complexity of the design concepts involved in such embedded systems. It aims to shorten the path from the specification to the implementation of future analogue mixed signal SoC/SiP hardware and embedded software in heterogeneous systems. Extensions for analogue mixed signal (AMS) modelling and simulation will be added to the SoC SystemC and IP-XACT domain standards through the Open SystemC Initiative (OSCI) and the electronic design automation (EDA) ACCELLERA standardisation bodies. Demonstrators based on industrial test cases are also being developed.

Improving competitiveness

Beyond Dreams is a joint effort by European semiconductor companies, together with leading European universities and research institutes, to address the design issues for mixed-signal systems. The consortium includes a major systems supplier and SME tool specialists in the AMS design domain.

The overall objective is to improve the competitiveness of European industries in the domain of embedded mixed-signal system design by reducing the entire design time

and the cost of heterogeneous SoCs and SiPs. The project will improve the design refinement process of EAMS by providing a methodology, simulation and modelling framework, standardised languages, libraries and modelling formats that guide and instruct designers to perform architectural refinement of analogue/mixed-signal/RF subsystem design in the context of digital hardware/software co-design.

Development of a modelling and simulation platform will enable validation of communication and network protocols, architectures, analogue/RF subsystem specification and properties of the physical implementation in the early design phases. The improvement in design methodology will enhance both the quality and the competitiveness of the European chipmakers and related industries.

Applications developed in the project address specific future products from which all citizens will benefit, including those with minor or major disabilities and the elderly. For example, driver-assistance systems can reduce accidents and protect lives. Wireless-sensor networks can benefit healthcare and manufacturing industry by ubiquitous deployment of sensing technology to improve safety and comfort. Finally, new mobile communication systems will provide cheaper and higher bandwidth, simpler information access, integrated navigation systems, radio and mobile TV.

Knowledge sharing

The project will provide Europe's microelectronics and systems design companies with a common systems-level design environment for the modelling and simulation of digital hardware/software and analogue/RF at architecture level. The SystemC-AMS prototype language will be used for modelling and simulation and extended with descriptions that support the refinement methodology, methodology-specific libraries and also any documentation that is necessary to achieve standardisation in OSCI.

Although SystemC is already a well-known, widely accepted and used standard, SystemC-AMS is not yet at the same level of maturity. Further efforts are necessary to complete its definition and standardisation. Unique in this project is that all major European contributors and universities are actively participating in the standardisation of SystemC-AMS through OSCI.

The extension and maturation of the SystemC-AMS standard and related systems-level modelling methodology provides a significant competitive advantage for the industrial partners involved. The umbrella of the MEDEA+ project is considered as an excellent framework for knowledge sharing, bundling pre-competitive development efforts and gaining immediate benefit from practical experience acquired during development of reference applications.

Until now, the design of analogue/RF systems has lacked a methodology which tightly interacts with digital approaches as analogue/RF design still runs bottom up, while hardware/software co-design tends to run top-down. Furthermore, models of computation (MoC) used for modelling and simulation of hardware/software systems and of analogue or even RF systems are fundamentally different. In the near future, these difficulties will be exacerbated since systems will become more and more heterogeneous.

As an alternative to the purely top-down refinement employed for digital-system design, a combination of top-down refinement and bottom-up integration of architectural properties can be used for EAMS systems. Through successive refinement steps, abstract building blocks can be augmented with architectural properties such as noise, power consumption and supply voltage domains.

These architectural refinements are usually available from bottom-up by measurement or by characterisation of intellectual property (IP). This will allow designers to set up simulation scenarios to have a very specific trade-off between accuracy of the models and simulation performance.

Maintaining leadership

The outcomes of Beyond DREAMS will enable European chipmakers to keep pace with the increasing complexity and heterogeneity in embedded systems design. Applications will include wireless sensor networks, multiple-input multiple-output (MIMO) techniques for wireless local area networks and dynamic spectrum management, autonomous sensing and processing, multi-radio and cognitive radio, and automotive applications.

Success in this MEDEA+ project will reinforce the leadership position of the European semiconductor industry in these domains and expand market prospects on a worldwide scale. This in turn will improve employment opportunities with European companies that adopt the new technology.

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MEDEA+ focuses on enabling technologies for the Information Society and aims to make Europe a leader in system innovation on silicon.