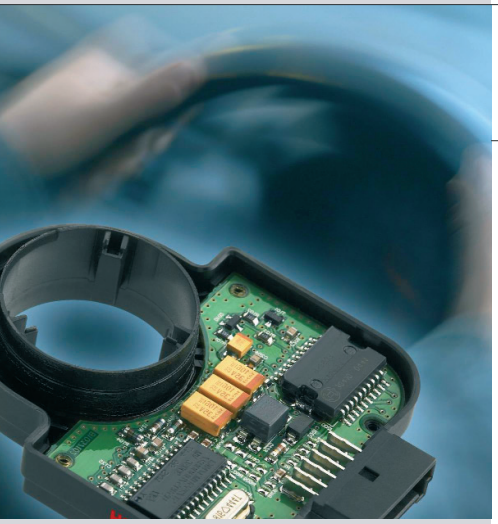
PROJECT RESULT

Design methodologies



A508: Specification and algorithm/architecture co-design for highly complex applications in automotive and communication (SpeAC)

High level design methodologies speed development of European SoC devices

Increasing design abstraction is crucial to fast, efficient development of system-on-chip devices, especially for automotive and communications applications. The SpeAC project has achieved great success by using a unified system-level design flow in pilot projects and by adding an infrastructure to support inter-company design. This approach is leading the way in the global electronic system-level (ESL) design market, with the results strongly influencing the evolution of ESL design worldwide. A highly application-oriented structure meant project achievements could be exploited immediately.

Modern vehicles exploit numerous electronic control units connected via an advanced communications network that have to satisfy tough real-time and reliability constraints. In addition to this complexity, the highly heterogeneous nature of automotive electronics systems, consisting of analogue, digital, mixed analogue-digital, micro-mechanical and software parts, poses challenges to system-level design methods.

Mobile communications and multimedia access systems have strict low-power demands that only can be met with higher levels of integration. And dramatic demands for new features in these areas have increased system complexity. In addition, ever higher system performance requirements and time-to-market pressures have required new methods enabling early systems analysis and a seamless overall design flow.

Ensuring efficient design flow

Complete system-on-chip (SoC) devices can provide the solution but have to be considered within the context of the entire electronics system. Architectural decisions must be evaluated early to ensure an efficient design flow for complex systems without time-consuming design iterations. The most effective method for improving design efficiency is to raise the level of abstraction at which creative work is done.

The MEDEA+ A508 SpeAC project set out to build a new generation of system-level front-ends above current design flows. The goal was to improve significantly the design productivity of SoC solutions for key European car and mobile communications applications. The high quality and safety requirements in vehicles as well as the pressure to reduce time to market accompanied by increasing functionality in mobile communications demand a well-tailored system-level methodology and design tools.

SpeAC addressed the next highest level above hardware/software co-design on predefined platforms. The main target was specification, algorithm/architecture optimisation and architecture generation to provide the applications-oriented platforms required. To manage this layered approach seamlessly, the consortium included not only chipmakers and systems houses but also the R&D centres of several major electronic design automation (EDA) vendors.

The MEDEA+ project overcomes design complexity by reusing functional blocks – IP cores – based on given platforms and modelling at higher levels of abstraction using automated translation to less abstract levels. Integrating core development tools/models in more complete systems environments overcomes the problem many small or medium-sized subsystem developers run into through lack of contact with the final context.

Exploiting strong competence

Despite global uncertainty about future ESL design, different views on methodology have consolidated towards the system-level design flow supporting heterogeneous, applications-oriented systems specifications propagated by SpeAC as a result of the strong systems engineering competence in Europe.

The results achieved fulfil and exceed expectations at the beginning of the project. In the first pilot trials, a design-time reduction of 75% and a verification-time reduction of 80% combined with a more reliable and predictable design process were achieved using the seamless SpeAC design flow starting from a MATLAB/Simulink specification.

The Simulink-based design and synthesis methodology is based on an efficient block-transformation strategy that includes automated test-bench support. In addition, SystemC has been established as the preferred integration and simulation language at system level. SystemC-based case studies resulted in design time and area reduction of some 30%, combined with consistent performance.

Another important step towards a general design entry for automotive and mobile communication applications was to include Unified/Systems Modelling Languages (UML/SysML) for modelling the structure of the entire SoC. The coexistence of UML/SysML and MATLAB/Simulink entries into a seamless design flow is a prerequisite for efficient handling of complex heterogeneous designs.

Use of SystemC as the integration language strongly accelerates application-specific systems design and strengthens Europe's core competence in systems engineering and integration.

Managing complex design

The seamless tailored systems-level design flow proposed by SpeAC is now leading the way in the global ESL design market. The flow and tool solutions developed at the beginning of the project have already strongly influenced the evolution of ESL design through channels such as EDA project partners, standardisation activities for SystemC/SysML, transaction-level modelling and assertion-based verification.

As a result of the MEDEA+ project, Europe is now well ahead of the USA and Japan. This has been achieved by building on the strong systems engineering competence in Europe. It results in a highly adaptable design flow that can be tailored to specific European application requirements.

The newly developed link between analogue and systems-level design is an important step to meet customer needs and maintain Europe's good market position in the mixed-signal area. Co-operation between leading systems integrators and smaller systems developers will strengthen Europe's position, as both benefit from a common language.

EDA equipment suppliers have started to provide the new tools needed for European applications domains, and system-level design methods are already helping reduce time to market and strengthen European suppliers. All this will help face tough worldwide competition and strengthen Europe's key industries.

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