Project profile

Cluster for Application and Technology Research in Europe on NanoElectronics

CA701 | A unified virtual-prototyping design environment to overcome challenges to specification, dimensioning and verification of multi-physical domains [H-INCEPTION]

PROJECT CONTRIBUTES TO

Communication	✔
Automotive and transport	✔
Health and aging society	✔
Safety and security	
Energy efficiency	
Digital lifestyle	
Design technology	✔
Sensors and actuators	✔
Process development	
Manufacturing science	
More than Moore	✔
More Moore	
Technology node	

Partners:

STMicroelectronics
Continental Automotive France SAS
Magillem Design Services
COVENTOR
ATRENTA
Brio Apps AlphaSip
Université Pierre et Marie Curie
Ecole Centrale de Lyon
Fraunhofer IIS/EAS
Océ Technologies
Dizain-Sync
Reden Holst Centre/ Imec-NL
Twente Institute for Wireless and Mobile Communications
TU Delft (TUD)

Project leader:

Olivier Guillaume
STMicroelectronics

Key project dates:

Start: December 2012
End: December 2015

Countries involved:

France
Spain
Germany
Netherlands

Website

https://www-soc.lip6.fr/trac/hinception

This project is developing and deploying a novel unified design-methodology and tools to provide system-level design and verification for new types of emerging applications which require microelectronics that closely interacts with the surrounding environment in different physical domains. The H-INCEPTION project consortium (comprising four European countries with broad ranging skillsets) will provide European industry with an ecosystem delivering all the design-technology ingredients – from design and verification methodology to the essential modelling languages and simulation engines.

New types of emerging applications require microelectronics with embedded software which closely interacts with the surrounding environment in different physical domains (like optical, mechanical, acoustical and biological). However, design errors such as functional incorrectness, wrong interfaces, or non-compliance to the initial product specifications, often occur and are recognised too late in the design cycle. This leads to additional design spins and delayed schedules due to a necessary reimplementation, which all hamper market introduction.

Better modelling and verification

Clearly, a global system representation (including all involved physical/engineering domains) is missing, especially in the early design stages. It would certainly prove very beneficial to be able to verify up-front the correctness of the multi-domain system architecture and to have an accurate view of the way in which all domains interact together.

This calls for the system modelling and verification of the entire multi-domain system, preferably even before starting the implementation of the individual parts. What is therefore needed is a modelling/design, simulation, and verification environment that can assist system designers to dimension, partition, and thus 'architect', such multi-domain systems appropriately. A key issue is to validate the interaction between the different physical domains.

Furthermore, microelectronic systems are functionally very tightly interwoven with the embedding application, urgently requiring the ability to design the microelectronic system in its context of use: embedded in its application that includes at least one specific physical domain and its associated environment. This calls for the ability to model, analyse, verify, and validate the entire system during its development cycle.

CA701 | **A unified virtual-prototyping design environment to overcome challenges to specification, dimensioning and verification of multi-physical domains** [H-INCEPTION]

Innovative methodology and simulation tools

H-INCEPTION is building a unified design environment where the system definition, design partitioning across the different physical domains, and its integral functionality, can be analysed and verified including the interaction with the overall application environment. In fact, this design environment will be deployed within European Industry as a customisable ecosystem delivering all critical missing design technology ingredients, from design and verification methodology to the essential modelling languages and simulation engines.

By means of multi-domain virtual prototypes (MDVP), an abstract view of the entire system is created, which allows its thorough analysis at various design abstraction levels. The development and use of such a virtual prototyping approach requires the introduction of an innovative system design methodology and its associated tools that address the system design needs for multi-domain microelectronics assisted systems. This new methodology and tools are mandatory to handle properly the increasing complexity of these kinds of applications.

Notably, H-INCEPTION introduces key enabling technologies to implement this unified design environment for virtual prototyping of multi-domain microelectronics-assisted systems, by means of a:

- Methodology for system design, architecture exploration and verification of multi-domain systems;
- Very fast system simulation framework for multi-domain systems;
- 'Correct by construction' approach for the integration of multi-domain systems;

At the same time, H-INCEPTION is driving another of its goals: standardisation. It will propose new extensions (MDVP), covering multi-physical domains, and their standardisation to the OSCI SystemC AMS and Accellera IP-XACT committees. SystemC and IP-XACT are widely used by the digital designer community building virtual prototypes.

Rich project consortium

The project group – representing five countries – is composed of industrials partners originating from different horizons: semiconductor and fabless companies, equipment suppliers, OEM, EDA vendors, research institutes and universities experienced in different applications domains such as automotive, wireless, avionics and biomedical and will all contribute to the creation and validation of this unified design methodology and ecosystem, simulator and framework to address the incoming application challenges.

Maintaining leadership and competitive edge

It is important to look at the benefits that can be derived from H-INCEPTION to determine the future success and usefulness of this project. To start off with, enabling technologies provided by H-INCEPTION will significantly improve the competitive position of European industry by allowing the co-designing of microelectronic platforms and enabling European semiconductor companies and OEMs to keep pace (and outperform the competition) in the face of increasing complexity and heterogeneity that is required to keep its leading position in system design and integration.

For example, the creation of a SystemC-based language definition with an open-source proof-of-concept implementation will ensure European industry keeps its leadership position in the application of advanced system-level design methodologies and tools. This will also result in the development of better and high quality products and systems, which are available earlier on the market.

Furthermore, European semiconductor companies producing 'correct by construction' prototypes and delivering these virtual solutions to their system integrators will be able to reduce development time by 3-6 months. Industrial partners will therefore be in a leading position to match customer demand, and save development costs by introducing new 'proof-points' and reducing design iterations in the total value chain. This know-how will further strengthen Europe's pole-position in MDVP products and solutions, resulting in increased European competitiveness and employment.

And there are plenty of areas where H-INCEPTION's role will be significant. In the near future, devices and embedded systems will offer more functionalities based on (wireless) connectivity and communication with their environment. Typical applications include toll payment with mobile phones; enhanced car-safety by monitoring the road/traffic control; using e-passport for secure (internet) payments; wireless sensor networks for healthcare monitoring; and sensing technologies (to improve, for example, the safety and comfort at work,) etc. Notably, these sectors will secure the competitive power of Europe and are predicted to grow by around 19% – from $163 billion to $195 billion – between 2011 and 2014.

CATRENE Cluster for Application and Technology Research in Europe on NanoElectronics

CATRENE Office
9 Avenue René Coty - F-75014 Paris - France
T. +33 1 40 64 45 60
E. catrene@catrene.org
www.catrene.org

CATRENE (Σ! 4140), the EUREKA **C**luster for **A**pplication and **T**echnology **R**esearch in **E**urope on **N**ano**E**lectronics, will bring about technological leadership for a competitive European information and communications technology industry.

CATRENE focuses on delivering nano-/microelectronic solutions that respond to the needs of society at large, improving the economic prosperity of Europe and reinforcing the ability of its industry to be at the forefront of the global competition.