Technology Transfer in Computing Systems

D3.3: Individual TTP3 abstract

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TETRACOM D3.3: Design of a digital processor for 3D Hall sensors conditioning in automotive applications

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Sensor technologies in automotive applications have become more and more pervading in the car systems. The complexity of signal processing algorithms is growing with the development of innovative features on each new sensor generation. The limit to the complexity growth is the cost, that mainly depends on the circuit's area devoted to the new digital signal processing algorithm.

Pisa University has a long lasting experience in intellectual property (IP) macrocell for sensor conditioning in automotive applications. Ams AG is interested in increasing the market share in the automotive magnetic sensor solutions for position, rotary, 3D and displacement sensing applications.

The aim of this TTP is to provide ams AG with a flexible digital IP capable of processing different magnetic sensor signals thus reducing design and verification effort and time-to-market to meet different customer specifications.

The existing IP at Pisa University has been optimized towards ams AG requirements for a large set of magnetic sensor conditioning. The design space of the processor has been preliminarily explored with an ad-hoc end-to-end system behavioral model, including a 3D magnetic sensor, the analog front-end and a bit-true digital signal chain. Pisa University transferred to ams AG an accurate model of 3D magnetic sensors, and they strictly collaborated for a realistic analog front-end model. The complete high-level system model allowed an evaluation of conditioning performances, algorithm precision and final specification of the digital IP, including the most suitable architecture.

The resulting design presents a systematically lower percentage error (up to 0.05%) on equal bit width logic with respect to reference design already available in ams AG. The processing time needed for a full chain computing is reduced by 41%. The most important result is the area reduction of 30% with respect to the previous design; this data implies a great benefit as far as production costs are concerned.

A test chip on 350 nm CMOS technology, currently under development by the company, will prove the effectives of the results towards the development of new 3D magnetic sensors exploiting the flexible digital IP from University of Pisa.

During this activity, Pisa University, also put the basis for a new TTP by proposing a more general software based architecture to address the conditioning of a wider set of sensors (magnetic, capacitive and inductive) with a single IP processor.