Students Wanted

Masters, Doctoral, Post-Doc and Professional Researchers

(with financial support)

Configurable Integrated Power Input/Output Systems for Avionic Applications

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Industrial Partner: Thales Canada Avionics
Government partner: Natural Sciences and Engineering Research Council of Canada (NSERC)

Description: Thales Canada Avionic develops control systems for avionics applications, which operate in harsh environments that may compromise the functionality of very high-density chips: electromagnetic interference, lightning strikes and cosmic radiations. The company needs to develop a generic power interface for different avionics applications with a high level of criticality: flight control, spoilers control, flaps control. However, such circuitry requires a lot of space on PCBs when implemented as discrete components, such as in the company's existing products. A reasonable trade-off between ASICs and discrete components is the concept of System in Package (SiP). SiP allows more than one integrated circuit inside the same package with very dense interconnects between bare-dies. In addition, SiP technology now allows chips of heterogeneous technologies to be integrated inside the same package, giving designers more flexibility.

Heterogeneous integration of high power and high voltage systems along with lower power systems through SiP technologies in a high reliability context suited to avionics is the focus of this collaborative research project. Ultimately, SiP integration of the entire power system would be a significant reduction in the PCB dimensions for the power circuits and potentially enhanced functionality. Accordingly, the main objective of the research project is to develop techniques to design compact, configurable and integrated input/output power systems for transportation vehicles under harsh conditions. A collection of highly flexible and reconfigurable elements to support a plurality of monitoring and controlling functions for power systems will be investigated and designed. These techniques will allow integrating these heterogeneous elements into a minimum set of SiP modules.

Looking for candidates in one or several of the following areas:

Analog integrated circuit design (positions at all graduate levels)

- Analog integrated circuit design in CMOS technology: amplifiers, limiters; isolators; protection circuits; voltage, current, temperature sensors; switch capacitors;
- Knowledge of integration constraints of multiple bare integrated circuits in SiP: EMI, power supply and signal integrity, switching noise, electro-mechanical limits;
- Physical design of high voltage CMOS integrated circuits (layout, place-and-route, simulation, verification);
- Design of power electronic circuits (<45V, <5A));
- Design techniques for electronic circuits that operate in harsh environments: diagnostic, robustness, liability, fault detection and tolerance;
- Knowledge of Cadence suite, semiconductor technologies, ASICs, power discrete devices, Verilog-AMS and/or signal processing is an asset;
- *Required background*: electrical engineering

MEMS design (Ph.D. students)

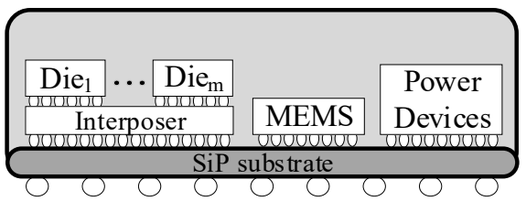
- Design of high power MEMS switches;
- Study and model multiple thermal, electrical and mechanical constraints in an array of MEM switches;
- MEMS post-processing in lab: sprayed-resist lithography, sputtering, chemical vapor deposition and shadow masking;
- Knowledge of ANSYS Mutiphysics, COMSOL and MEMS technoloiges is an asset;
- *Required background:* electrical engineering, physical engineering.

Design of heterogeneous SiP systems (post-doc and professional researchers)

- Study, measure, model and validate physical and electrical characteristics and their limits (temperature, speed, voltage, power, EMI, etc.) in heterogeneous SiP systems;
- Integration of bare integrated circuits, MEMS and discrete power devices in SiP;
- Design and assembly of SiP prototypes;
- Robustness, security and liability characterization of SiP prototypes;
- Knowledge of Cadence suite, ANSYS, COMSOL,MEMS and LTCC technologies is an asset;
- *Required background:* electrical engineering and preferably design experiences of heterogeneous SiP systems.

Test and verification (intern positions)

- Design and run test regression;
- Develop test structures to characterize PCB and SiP system prototypes;
- *Required background*: electrical engineering students



Physical view of an SiP example

Le génie pour l'industrie

Conseil de recherches en sciences naturelles et en génie du Canada
Natural Sciences and Engineering Research Council of Canada
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