École Centrale de Lyon - INSA de Lyon - Université Claude Bernard Lyon 1

Ampère

Unité Mixte de Recherche du CNRS - UMR 5005

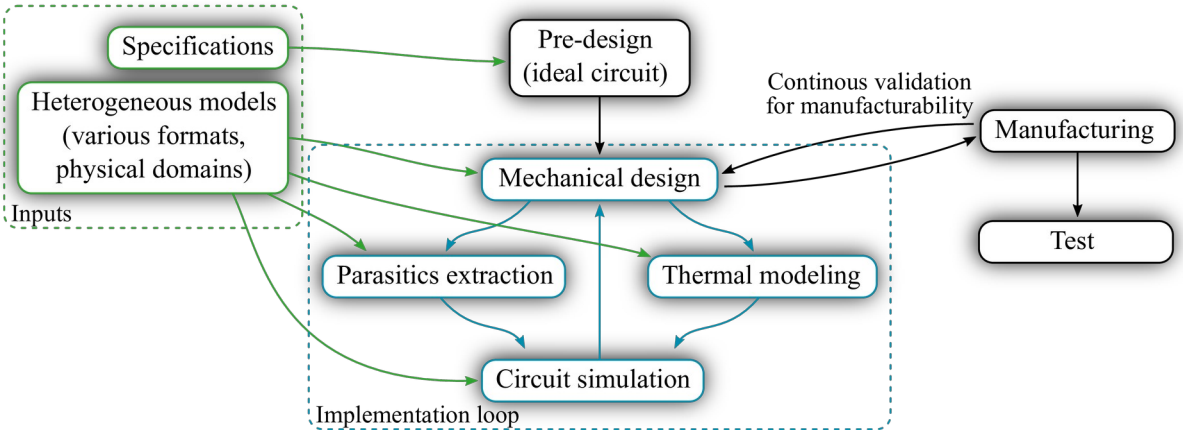
Génie Électrique, Automatique et Bio-Ingénierie

Internship offer – Design tools for power electronics
27/10/2023

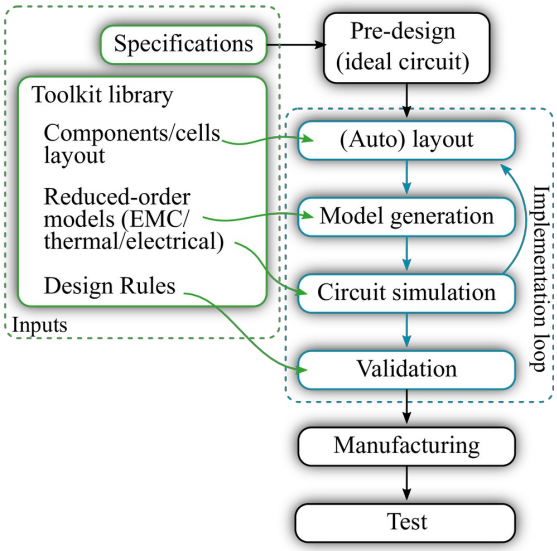
M/F internship - Design tools for power electronics

Context

The design of power electronics converters is a complex topic : once a circuit topology has been chosen and components have been selected, the designer must proceed to the mechanical implementation, calculate the circuit parasitics, estimate thermal performance, and perform simulation. In most cases, it is actually not possible to simulate all these aspects so repeated experiments are necessary, often requiring several prototyping iterations.



At Ampère, we have developed a software toolchain which can automatically generate suitable models from a converter design, streamlining the design procedure as follows.



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In practice, this design toolchain relies on commercial software as much as possible (Altium designer for PCB design; Ansys Q3D Extractor for the calculation of circuit parasitics; Ansys Icepak for thermal analysis…), with some custom code to manage data exchange between the main pieces of software. This toolchain takes the printed circuit board design of a power converter as its input, and automatically generates thermal and electrical models which can be simulated using, for example, SPICE simulators. The entire process takes minutes, while doing the same thing manually would requires hours or days of a skilled engineer.

Objective of the internship

While this design toolchain has been successfully demonstrated (some results have been published in [1], and more are to come), the following is still needed:

- identify the limits in terms of circuit complexity (what is the maximum circuit complexity which can be reasonably handled with this toolchain?)
- apply the design toolchain to more converter designs, and perform experimental validation
- implement some optimizations to the existing code base (geometry simplification, data exchange, etc.)
- implement some more advanced thermal models for via groups.

Candidate profile

Candidates are expected to have a background in electrical engineering, with preferentially some experience in the design of printed circuit boards, and some experience in object-oriented programming.

They should be in the final year of their Master's degree, looking for a 5 or 6-month internship.

The working language can either be French or English (although a good level of English is expected in all cases).

Hosting institution

Laboratoire Ampère is a research group based in Lyon, France. It has about 200 members, including 76 permanent researchers and 76 PhD students. Laboratoire Ampère addresses many research topics in the field of control-, Electrical- and Bio-engineering.

The intern will be located in Villeurbanne, on the campus of INSA Lyon (one of the locations of Laboratoire Ampère). He/she will be provided with a computer with the required software installations, and get access to the lab for experimental investigations.