CURRICULUM VITAE
(extended abstract)

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Dario D'Amore received the Laurea in Electrical Engineering from Politecnico di Milano, Milan, Italy, in 1987. He became Assistant Professor in 1988. From 1997 to 2006 e was with Politecnico di Milano, as Associate Professor of Electrical Engineering. Since 2006 he is Full Professor of Electrical Engineering and since then, he has been teaching "Basic Circuit Theory" at Politecnico di Milano. In 2011 he is Vice-Dean of the 5^{th} School of Engineering (Ingegneria dell'Informazione) of Politecnico di Milano.

Scientific activity, started in 1986, has been mainly centered on circuit simulation. The interest was initially focused on strongly nonlinear circuits typical of power electronics (rectifiers, switching supplies) since their simulation, often mandatory for the designer, can be critical, or even impossible, using conventional circuit simulators. Research efforts have been concentrated both in efficiency and robustness improvements of existing simulation techniques and in the study of new simulation techniques in time and frequency domain. In the last years, the attention has been concentrated on the thermal effects that can be induced by self and mutual heating over the electrical behavior of an electronic device or system. In fact, in power electronics circuits, as well as in microelectronics circuits, the heating effects can strongly perturbs the nominal behavior of the circuit and can often lead to malfunctions of even failures.

Gaining insight in electro-thermal simulation requires an in-depth study in terms of thermal and electro-thermal modeling and in terms of simulation algorithms; all these issues are today of great scientific interest.

Analysis and simulation of coupled electrical and thermal effects is usually achieved by identifying a circuit model of heat diffusion and accumulation inside the device and in the external structure (pcb, package) that can be easily used, together with the electrical circuit model, in an homogeneous simulation environment. A central aspect of this approach is the modeling through a lumped equivalent circuit of an intrinsically distributed phenomenon as is the heat diffusion. Specifically, a parameter "junction temperature" is needed for each device in order to globally describe the effects of the distributed temperature field inside the device itself. The research activity is organized in the following items:

1) Identification of electrothermal models for devices and electronics systems. The identification of a circuit model for a thermal phenomenon requires the definition of a parameter "junction temperature" for each generic electrical circuit element. Research has lead to a definition for such a parameter that allow the determination of an equivalent lumped circuit thermal model that retains the fundamental properties of passivity and reciprocity typical of the distributed thermal phenomenon. The extraction procedure has been coded so that, staring from the device layout description, an equivalent netlist is produced.

2) Techniques for complexity reduction. This aspect is of paramount importance since the extracted thermal networks are extremely large and cannot be directly used for circuit simulation. Some new techniques has been developed to produce reduced equivalent thermal networks that still maintain a good accuracy and allow the simulation of large electrothermal problems.

3) Qualitative study of dynamical phenomena due to electro-thermal coupling. The description of an electrothermal system through an equivalent electrothermal network allows to gain insight on some new interesting dynamical phenomena that are not purely electrical nor thermal but that instead arise from the electro-thermal coupling. The research has lead to the introduction of a simple power BJT electro-thermal model able to describe the thermal dynamic in the active region of the device. The thermal dynamic is governed by time

constants of the same order of that of the electrical part. The model obtained allows to predict the occurrence of electrothermal oscillation (electrothermal resonance) and to determine with precision the starting condition from which electrothermal resonance can start up. The phenomenon has been largely confirmed by experiments on a commercial power BJT. This allowed also to identify an experimental procedure for the extraction of the equivalent thermal networks which refers to the fast device thermal dynamics. The same model allowed to explain the instability that can arise when more bipolar devices (BJTs or Diodes) are parallel connected. Finally, the electrothermal resonance has been studied, modeled and experimentally verified also for MOSFET devices.

4) Multiphysics modeling and simulation of high efficiency photovoltaic systems. This research is inspired by the previous research lines and aims at developing a design methodology for the design and the optimization of hybrid solar concentration modular panels for the combined production of electrical and thermal energy. Being this a multiphysics problem, modeling and simulation of the whole system is needed in order to achieve optimization and control of the whole system (PV panels, converters, heat exchanger). The primary goals are: -The achievement of a multiphysics model of the PV panel and of the heat recovery system -The achievement of a macromodel of reduced size of the hybrid panel, allowing the electro-thermal simulation of a large field of such panels.