## Abstract

This habilitation thesis presents scientific and professional achievements accumulated between 2005-2015, after completing the thesis. The research conducted in this period was focused on the following areas:

• Analysis, modeling, simulation and implementation of DC-DC power converters;
• Analysis, modeling, simulation and implementation of DC-AC power converters, in particular resonant converters used in induction heating systems;
• Analysis, modeling, simulation and design of electronic circuits, in terms of signal integrity and power integrity.

As a result of this research have been published over 41 articles, of which 1 article in ISI magazine, ISI Proceedings articles 13 and 20 are indexed in international databases. There were also published five books and a number of recognized national publishing houses and a book chapter in international publishing. This book chapter has a total of over 20000 downloads in appearance, and the book is included on the Matlab official website. In addition, it should be noted that I have participated in more than 25 research contracts, of which 5 of them are director or project manager. Of these 5 projects, two are international projects with companies in the delivery of equipment for induction heating systems.

This thesis reviews the contributions for the modeling of electronic circuits and low power, of which we selected three directions:

• D1. Analysis, mathematical modeling, simulation and DC-DC converters implementation
• D2. Analysis, mathematical modeling, simulation and implementation of resonant converters
• D3. Modeling and design of power distribution network on the electronic printed boards.

The main results from the investigations direction D1 are related in the DC-DC converters modeling. As modeling and simulation methodology in these converters, it was left to analyze time-converters operating description of the many each interval by differential equations, following the implementation of these equations in a simulation platform designed for each type of converter. The results are then verified and validated by simulating dedicated circuit simulators such as PSpice Orcad and Matlab / Simulink. It starts with analysis of the basic structure of dc-dc converters, following

the introduction of these parasitic elements. The results are valued by publishing a total of 17 scientific papers indexed in Thomson Reuters ISI database.

The main results from the investigations in the direction D2 are related to modeling of DC-AC resonant converters, especially those used in induction heating systems. Modeling and simulation for these converters starts with analyze time-converters operating description of the many each interval by differential equations, following the implementation of these equations in a simulation platform designed for each type of converter. The results are then verified and validated by simulating dedicated circuit simulators such as PSpice Orcad and Matlab / Simulink. They have been analyzed in half bridge converters and bridge converters. Some of the results obtained during this research direction is based on collaboration to complete of 2 Ph.D. thesis, *Switching Converters Modeling* conducted by as.ing. Adrian Taut and *Theoretical and experimental modeling and simulation of power converters resonan*t conducted by as.ing. Ionel Baciu. The results are valued by publishing a number of 16 scientific papers, 12 of which are indexed in the database ISI Thomson Reuters. One of these works, A Tool for MATLAB Simulation of Power Resonant Converters was awarded the 2012 IEEE International Symposium conference for Design and Technology in Electronic Packaging.

The results of research in the direction D3 are connected to the modeling of electronics printed boards in terms of the integrity of their supply. It watched planes modeling of supply wafer so that the induced voltage ripple remain at an acceptable level, and based on this modeling can propose methods of choice and positioning of decoupling capacitors. Were made simulation and modeling in Orcad PSpice of the supply planes and Matlab models, 2D and 3D, to capture as faithfully occurring phenomena. Some of the results obtained during this research direction is based on collaboration to complete a doctoral thesis, *Power integrity analysis of electronic printed boards*, to Mr. as.dr.ing. Raul Fizesan. The results are valued by publishing a number of papers 8, 6 of which are indexed in the database ISI Thomson Reuters. One of these works, the *Why the Mounting Inductance is Important in Designing a PDN?* was awarded the 2015 IEEE International Symposium for Design and Technology in Electronic Packaging.

In this habilitation thesis I wanted to present a methodology for modeling of low and high power electronic circuits, considering that under the leadership of future thesis is important to inoculate PhD students a rigorous approach to the problems. As a result, I did a survey of all personal achievements but I tried to point out ways in which, starting from simple to complicated, to analyze and modeling complex

electronic circuitry, highlighting not only their steady state behavior, but more importantly, transients behavior that may occur in such circuits.