PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Raffaele Salvato

XXXII Cycle

Training and Research Activities Report – First Year

Tutor: Prof. Vincenzo d'Alessandro

1. **Information**

   I graduated in Electronic Engineering at Università di Napoli Federico II in Aprile 14th 2015, with thesis "*Interpolation in Fast and Fast Factorized Back Projection Algorithms*". Now I belong to XXXII cycle of Information Technology and Electrical Engineering (ITEE) PhD at Università di Napoli Federico II. My fellowship is financed by Infineon Technologies Austria AG. My tutor is Prof. Vincenzo d'Alessandro

2. **Study and Training activities**

   [1] Courses:

   - Analisi Funzionale: complementi – Prof. Renato Fiorenza

   [2] Seminars:

   - IBM Cognitive Computing: Challenges and Opportunities in Building an Artificial Intelligence Platform for Business – Prof. Pietro Leo
   - Cognitive Computing and Da Vinci Robot. Research Proposal and Discussion – Prof. Paolo Maresca
   - How to organize and write a scientific Rebuttal – Prof. Pasquale Arpaia
   - Fuzzy logic, genetic algorithms and their application to next generation networks – Prof. Flora Amato
   - Sound and Music in Human Computer Interaction – Prof. Antonio Rodà
   - Superconduttività, opportunità di sviluppo e di trasferimento tecnologico – Prof. Gianpiero Pepe
   - From Mathematical Formalization to Artificial Visul-Attention – Prof. Kurosh Madani
   - DataFlow Supercomputing for BigData Analytics – Prof. Veljko Milutinovic
   - The estimation of the cost of software development projects – Prof. Javier De Andres Suarez
   - Exploiting speech production knowledge for deep learning based automatic speech recognition – Prof. Leonardo Badino
   - Deep learning for robot navigation and perception – Prof. Wolfram Burgard

   [3] External Courses:

	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary
		Credits year 1						
Modules	20	0	0	0	0	7	0	7
Seminars	5	2.3	1.8	0.4	0	0	0	4.5
Research	35	0	0	17	9.1	11	11	48
	60	2.3	1.8	17	9.1	18	11	60

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3. Research activity

My research activity is about improving existing BJT model, optimised for small signal radio frequencies applications, to be applied to Large Signals application. The analysed devices are Heterojunction Bipolar Transistor (HBTs) in Silicon/Germanium, used in very high frequencies applications, like 5G communications (6GHz, 28GHz, 39GHz, 60GHz), automotive radars (24GHz, 77GHz), biomedical scanning applications (20GHz), point to point communication (sub-THz).

HBTs in Silicon/Germanium are fundamental technology for amplifier design at frequencies of gigahertz. Unfortunately, existing models fit with measures only for DC and small signal applications, but not for large signal applications. My research activity is improving existing models, so that they fit also in large signal applications.

The first step of my research was to study existing models, starting from Gummel&Poon model, but with particular concentration on HICUM model. Then I learn to use instruments (Power supply, multimeter, VNA, Parameter analyser, probe station, ecc.) for integrated circuits characterization. Then I measured DC characteristics and extrapolated parameters for HICUM model of HBT. However, some parameters required a frequency analysis that is not yet done due some technical problems. So, these parameters were calculated using existing parameters of HICUM model and fitted to the measures.

Next step of my research activity is to complete HBT characterization and compare HBTs simulation at large signal and high frequencies with measures. Then determine physical phenomena that cause deviation between measures and simulation and model them, changing existing HICUM model.

References:

[1] Ian E. Getreu, "*Modeling the Bipolar Transistor*", Elsevier Scientific Publishing Company, 1978

[2] John D. Cressler & Guofu Niu, "*Silicon Germanium Heterojunction Bipolar Transistors*", Artech House, 2002

[3] Michael Schröter, Anjian Chakravorty, "*Compact Hierarchical Bipolar Transistor Modeling with Hicum*", World Scientific, 2009

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Mike Golio & Janet Golio, "*RF and Microwave Circuits, Measurements and Modeling*", CRC press, 2008

Collaboration:

Infineon Technologies Austria AG

4. Products

In this first year my research activity has not produced any publications yet

5. Conferences and Seminars

In this first year I did not participate at any conference an seminary.

6. Activity abroad

Starting from June 2017, my research activity has been at least all aboard. In particularly I has been in Villach (Austria), at Infineon Technologies, where I used their software and their instruments.

Dates: 12/06/2017 – 31/07/2017
                01/08/2017 – 03/08/2017
                28/08/2017 – 30/09/2017
                16/10/2017 – 25/10/2017
                05/11/2017 – 22/12/2017
                02/01/2018 – 31/01/2018

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7. Tutorship

In this first year I did not do any tutorship