**PhD in Information Technology and Electrical Engineering**

**Università degli Studi di Napoli Federico II**

# PhD Student: Luigi Ferraro

**XXIX Cycle**

## Training and Research Activities Report – First Year

## 1. Information

Name Surname

Luigi Ferraro , Electrical Engineer – University of Naples " Federico II "

PhD Cycle and University

XXIX Cycle – ITEE University of Naples " Federico II "

Fellowship type

POR Campania FSE 2007/2013, Asse IV e V, di cui a progetti reti di eccellenza tra Università – Centri di Ricerca – Imprese, Progetto POLIGRID CUP B65B09999920007

Tutor

Diego Iannuzzi

## 2. Study and Training activities

### a. Courses

- From M.Sc. course - Ingegneria Indistriale : "Electrodynamic properties of novel materials and devices"
- From M.Sc. course – Ingegneria dei Materiali : " Misure per l'ingegneria dei materiali"
- From M.Sc. course – Ingegneria Elettrica : " Modellistica di macchine e convertitori elettrici"
- From Ad hoc Modules – " Europrogettazione "

### b. Seminars

- "State of the art in Power Converters for High Voltage DC Transmission systems"
- "Nano-carbon based components and materials for high frequency electronics"

### c. External Courses

- 15th Edition of the European Ph.D. School : Power Electronics, Electrical Machines, Energy Control & Power Systems

## 3. Research Activity

### a. Title

- "Experimental study on a laboratory test bench for sea wave generation system"
- "Inductive charging system for electric vehicle"

### b. Study

With reference to the sea wave generation, a laboratory test bench specifically designed for sea wave generation systems, was used.

With reference to the inductive charging system the goal is to study in deep some aspects in terms of designing, sizing, control and experimental validation of a 10 kW industrial prototype of Inductive Power System for the Stationary and Dynamic charging station.

### c. Research description

In particular a DC Micro Grid is realized to experimentally validate the energy performance of a PM Brushless ball screw actuator, during motor-regenerative operative conditions, which is representative of an oscillating body wave generation system. The proposed architecture is based on a DC bus, which features the integration of renewable energy sources and buffered storage systems, with the aim of smoothing the natural power fluctuations of wave energy generation systems. The wave generation is simulated in laboratory by controlling an electric motor, which is directly coupled with the PM brushless generator. The experimental validation phase is mainly devoted to verify the design criteria of the architecture scheme and the control strategies of the power fluxes related to power converters.

IPT systems are conceptually like a transformer but they have low values of coupling coefficient between the primary and secondary. Therefore they are called *loosely coupled* systems. The main goal is to realize a laboratory prototype of 10 kW, suitable for both stationary and dynamic charging. The latter issue can be addressed by using a different pads topologies. In particular, several IPT systems are proposed in literature, among these the following two systems seem to meet our requirements: a) single-phase double D (DD) primary pad, buried under the path, coupled with a bipolar (BP) secondary pad installed on vehicle chassis; b) three-phase tripolar (TP) primary pad buried under the path, coupled with a bipolar (BP) secondary pad installed on vehicle chassis.

d. Collaboration

ENSEEIHT – "École nationale supérieure d'électrotechnique, d'électronique, d'informatique, d'hydraulique et des télécommunications" Toulouse – France – GEET – "Genie electrique electronique de Toulouse" numero ED 323

## 4. Products

a. Publications

"Experimental study on a laboratory test bench for sea wave generation system - ICAE 2014"

**Student: Luigi Ferraro** luigi.ferraro@unina.it

**Tutor: Diego Iannuzzi** iandiego@unina.it

**Cycle XXIX**

| | Credits year 1 | | | | | | | | Credits year 2 | | | | | | | | Credits year 3 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | | | 1 | 2 | 3 | 4 | 5 | 6 | | | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| | Estimated | bimonth | bimonth | bimonth | bimonth | bimonth | bimonth | Summary | Estimated | bimonth | bimonth | bimonth | bimonth | bimonth | bimonth | Summary | Estimated | bimonth | bimonth | bimonth | bimonth | bimonth | bimonth | Summary | Total | Check |
| **Modules** | 21 | 0 | 7 | 9 | 6 | 3 | 0 | **25** | 15 | | | | | | | **0** | 0 | | | | | | | **0** | 25 | 30-70 |
| **Seminars** | 3,3 | 0 | 0 | 0 | 2 | 0 | 0,4 | **2,4** | 3 | | | | | | | **0** | 0 | | | | | | | **0** | 2,4 | 10-30 |
| **Research** | 36 | 3 | 3 | 3 | 3 | 3 | 10 | **25** | 42 | | | | | | | **0** | 60 | | | | | | | **0** | 25 | 80-140 |
| | 60 | 3 | 10 | 12 | 11 | 6 | 10 | **52** | 60 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 60 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 52 | 180 |

# BIMONTHLY ATTESTATION OF ACTVITIES

**PhD Student Luigi Ferraro**

PhD in Information Technology and Electrical Engineering
University of Napoli Federico II

**Cycle XXIX,**
**Year FIRST**
Period: 1.1.2015 – 28.2.2015 (sixth two-months)

In the above reported period, the PhD student Name Surname attended the PhD course and carried out the training activities reported below.

| Type | Credits | Activity |
|---|---|---|
| Modules | 0 | 0 |
| Seminars | 0,4 | State of the art in Power Converters for High Voltage DC Transmission systems – Philippe Ladoux – 28.1.2015 |
| Research | 10 | 3D finite element analysis of a inductive power system, constituted of DD pad buried on the way and a pad BP on the vehicle. (DD-BP configuration).<br>Calculation of the coefficients of a induction power system, for different values of the air gap and lateral misalignments |

**Periods spent abroad**

30.01.2015-28.02.2015 ENSEEIHT – "École nationale supérieure d'électrotechnique, d'électronique, d'informatique, d'hydraulique et des télécommunications" Toulouse – France

GEET – "Genie electrique electronique de Toulouse"

**Published journal paper**

**Published conference papers**

21 February 2015

PhD student, Luigi Ferraro

Tutor, Diego Iannuzzi