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 – Second Year

Tutor: Diego Iannuzzi – co-Tutor: Stephane Caux

1. Information

Luigi Ferraro , Electrical Engineer – University of Naples " Federico II "
XXIX Cycle – ITEE University of Naples " Federico II "
Fellowship type:

- PROGETTO M.I.C.C.A - "Microgrid Ibride in Corrente Continua e Corrente Alternata" - PON03PE_00178_1 Titolo Borsa di Studio: "Sistemi di ricarica rapida ed ultrarapida per batterie di veicoli elettrici stradali"
- Bando Vinci 2015 - Contributi di mobilità per tesi di Dottorato in cotutela

Tutor: Diego Iannuzzi

2. Study and Training activities

a. Courses:
   - From M.Sc. course: Propulsione dei veicoli elettrici;
   - From M.Sc. course: Misure per l'automazione e la produzione industriale.

b. Seminars
   - Partial possibilistic regressio path modeling;
   - Mathematical modelling of atomic force microscopes;
   - Lagrangean relaxation and set covering;
   - Strategie di contrasto alla corruzione;
   - On the complexity of temporal equilibrium logic;
   - Beyond the data: how to achiev actionable insights with machine learning;
   - On motion planning, motion representation and its orbital stabilization for mechanical system;
   - Model based and pattern based GUI testing.

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	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	25	0	7	9	6	3	0	25	15	0	0	0	6	0	9	15	0							0	40	30-70
Seminars	5	0	0	0	2	0	0,4	2,4	5	0,6	1,6	0	0,4	2	0	4,6	0							0	7	10-30
Research	30	3	3	3	3	3	10	25	40	6	10	10	10	10	6	52	60							0	77	80-140
	60	3	10	12	11	6	10	52	60	6,6	12	10	16	12	15	72	60	0	0	0	0	0	0	0	124	180

Year	Lecture/Activity	Type	Credits	Certification
1	Eeuroprogettazione	Ad hoc module	3	x
1	Misura per l'ingegneria dei materiali	MS Module	9	x
1	modellistica di macchine e convertitori	MS Module	6	x
1	15th Edition of European PhD School PEEMEC - Gaeta 26 - 30 Maggio 2014	External Module	3	x
1	State of the art in Power Converters for High Voltage DC Transmission Systems	Seminar	0,4	x
1	Nanocarbon based components and materials for high frequency electronics	Seminar	0,2	x
2	"Mathematical Modelling of Atomic force Microscopes" - Dr. Martin Homer	Seminar	0,2	x
2	Partial possibilistic regression path modeling - Prof. Rosaria Romano	Seminar	0,4	x
2	Lagrangean relaxation and set covering - Prof. Gaudioso	Seminar	1	x
2	Strategie di controllo alla corruzione - Ordine Ingegneri	External Seminar	0,6	x
2	on the complexity of temporal equilibrium logic - Prof. Bozzelli	Seminar	0,4	x
2	Beyond the data: how to achieve actionable insights with machine learning - Dr. Matteo Santoro	Seminar	0,4	x
2	On motion planning, motion representation and its orbital stabilization for mechanical system - Prof. Anton Shiriaev	Seminar	0,4	x
2	Model based and pattern based GUI testing - Parte 1 - Prof. Ana Paiva	Seminar	0,8	x
2	Model based and pattern based GUI testing - Parte 2 - Prof. Ana Paiva	Seminar	0,8	x
2	Misure per l'Automazione e la Produzione Industriale – Prof. Rosario Schiano Lo Moriello	MS Module	9	x
2	Propulsione dei veicoli elettrici – Prof. Gianluca Brando	MS Module	6	x

3. Research activity

c. Title
Inductive charging system for electric vehicle

d. Study
The goal is to study in deep some aspects in terms of designing, sizing, control and experimental validation of 10 kW industrial prototype of inductive power system for the stationary and dynamic charging station.

e. Research description
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 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. The work has been focused on the developing of the mathematical model of the system starting from the chose of electromagnetic configuration (DD-BP pad topology), the circuit compensation and the power topology of the system. It is relevant element write the mathematical model in order to continue the study and sizing of the control system. We have used the results of the numerical simulations conducted in PSIM as a tool to check the coherence between the mathematical and numerical model. To simplified a non linear system, it has been linearized by means of small signal linearization.

f. Collaborations
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