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

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1. Information

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

XXIX Cycle – ITEE University of Naples " Federico II "

Fellowship type:

- Bando Vinci 2015 - Contributi di mobilità per tesi di Dottorato in cotutela

- PROGETTO C.A.P.R.I. – "Carrello per Atterraggio con Attuazione Intelligente" – PON03PE_00135_1
  Titolo borsa di studio: "Convertitori ad elevata frequenza di commutazione per impieghi in campo aereonautico"

Tutor: Diego Iannuzzi

2. Study and Training activities

    a. Courses
   - Formation d'anglais intensif: du 24 au 28 octobre 2016 - B1 - 25 heures

    b. Seminars
   - speech technologies at Trinity College;
   - Microcontrollori di misura;
   - challenging real-time measurement systems for immersive life-size augmented environment;
   - il monitoraggio della qualità del servizio oltre gli indicatori standard: l'esperienza sulla rete mobile di telecom italia;
   - the development of a fast pick and place robot with an innovative cylindrical drive;
   - embedded software validation;
   - reti di telecomunicazioni in Campania: esperienze ed opportunità;
   - DDoS detection in cloud and campus networks;
   - Oracle Italia:soluzionio oracle per la gestione dei big data, data base no sql e analytical;
   - an overview of the space vector;
   - les drones avancees technologiques et enjeux ethiques;
   - nanostructured materials based biosensors: engineering next generation of biomedical devices;
   - reactive power control in ac networks from the state of art to the chopper controlled impedance concept.

Student: Luigi Ferraro							Tutor: Diego Iannuzzi							Cycle XXIX								
luigi.ferraro@unina.it							iandiego@unina.it															
	Credits year 1							Credits year 2							Credits year 3								
	Estimated	bimonth 1	bimonth 2	bimonth 3	bimonth 4	bimonth 5	bimonth 6	Summary	Estimated	bimonth 1	bimonth 2	bimonth 3	bimonth 4	bimonth 5	bimonth 6	Summary	Estimated	bimonth 1	bimonth 2	bimonth 3	bimonth 4	bimonth 5	bimonth 6	Summary	Total	Check
Modules	25	0	7	9	6	3	0	25	15	0	0	0	6	0	9	15	0	0	0	0	5	0	0	5	45	30-70
Seminars	5	0	0	0	0,2	0	0,4	0,6	5	0,6	1,6	0	0,4	2	0	4,6	0	1,2	2	0	0,8	0,6	1	5,6	11	10-30
Research	30	3	3	3	3	3	10	25	40	6	10	10	10	10	6	52	60	10	10	5	10	10	10	55	132	80-140
	60	3	10	12	9,2	6	10	51	60	6,6	12	10	16	12	15	72	60	11	12	5	16	11	11	66	188	180

Note: Each "Credits year" group contains columns Estimated, bimonth 1, bimonth 2, bimonth 3, bimonth 4, bimonth 5, bimonth 6, Summary.

Year	Lecture/Activity	Type	Credits	Certification	Notes
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	speech technologies at Trinity College	Seminar	0,2	x	
3	Microcontrollori di misura	Seminar	0,5	x	
3	challenging real-time measurement systems for immersive life-size augmented environment	Seminar	0,5	x	
3	il monitoraggio della qualità del servizio oltre gli indicatori standard: l'esperienza sulla rete mobile di telecom italia	Seminar	0,4	x	
3	the development of a fast pick and place robot with an innovative cylindrical drive	Seminar	0,4	x	
3	embedded software validation	Seminar	0,4	x	
3	reti di telecomunicazioni in Campania: esperienze ed opportunità	Seminar	0,4	x	
3	DDoS detection in cloud and campus networks	Seminar	0,2	x	
3	Oracle Italia:soluzionio oracle per la gestione dei big data, data base no sql e analytical	Seminar	0,4	x	
3	an overview of the space vector	Seminar	0,8	x	
3	Formation d'anglais intensif: du 24 au 28 octobre 2016 - B1 - 25 heures	External Module	5	x	
3	les drones avancees technologiques et enjeux ethiques	Seminar	0,6	x	
3	nanostructured materials based biosensors: engineering next generation of biomedical devices	Seminar	0,4	x	
3	reactive power control in ac networks from the state of art to the chopper controlled impedance concept	Seminar	0,6	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 numerical 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 obtain a state space model of the proposed IPT system in order to derive more complex control scheme, 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 choose 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 simplify the system, it has been splitted in two parts, AC and DC side. Thus is possible because the value of operating frequency, between the two side is very different. In order to obtain a constant value of the charge battery current of the electric vehicle, it has been necessary operate on the value of duty cycle building a circuit that automatically adjust the duty cycle as necessary, to obtain the specified output current with high accuracy, regardless of disturbances or component tolerances. With the aim of analysing the performance of the control system respect to the possible misalignments, it has been taking into account the system for different values of misalignments along the x axis and y axis. Moreover

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in order to test the performance of the PI control, it has been simulated for two different profile of the reference output current.

    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

4. Products

    a.   Pubblications
"Magnetic Design of Inductive Polarized Couplers for IPT EV Charging System" – ESARS 2016