UNIVERSITÀ DI PAVIA

Anno Accademico 2017/2018

ELECTRICAL DRIVES FOR INDUSTRIAL APPLICATIONS

Anno immatricolazione	2016/2017
Anno offerta	2017/2018
Normativa	DM270
SSD	ING-IND/32 (CONVERTITORI, MACCHINE E AZIONAMENTI ELETTRICI)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	INDUSTRIAL AUTOMATION ENGINEERING - INGEGNERIA DELL'AUTOMAZIONE INDUSTRIALE
Curriculum	PERCORSO COMUNE
Anno di corso	2°
Periodo didattico	Primo Semestre (02/10/2017 - 19/01/2018)
Crediti	12
Ore	116 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO E ORALE CONGIUNTI
Docente	BASSI EZIO (titolare) - 11 CFU SZABO LORAND - 1 CFU
Prerequisiti	Principles of electrical engineering and mechanics, analysis of periodic waveforms, vector diagrams, basic elements of electrical machines and power electronics.
Obiettivi formativi	The course outlines in its first half the basic concepts about functional characteristics, design and applications of electrical variable speed drives at steady state, with a few hints on their control and transient behavior. In the second part are addressed items concerning the dynamical behavior of electrical drives: various regulation schemes are introduced, principally with induction and brushless motors, with different solutions as to the controlled variables and the regulation algorithms.

Programma e contenuti	This course is attended by the students of the students of the second year of the Laurea Magistrale degree in both Ingegneria Elettrica and in Industrial Automation Engineering. In the academic year 2017/18 a series of lectures (12 hours, 1 cfu, January 2018) will be given by Prof. L, Szabo, Univesrity of Cluj-Napoca (Rumenia) about "Special Electrical Machines" In the following are resumed the main topics of this course (the list is not in cronological order, but grouped according to the argument). Inverter-fed Induction machine Dynamic model of the IM and instantaneous torque; different reference system and transformation matrices; vector representation of three-phase variables; Field Oriented Control: direct and indirect implementaion, reconstruction of flux and torque variables, field weakening operation. Doubly Fed Induction Machine: rotor current limit and torque control. Direct Torque Control: selection of the inverter configuration & modulation strategies; Direct Self Control: hexagonal stator flux path. A.C. current control Control of the currents of a three-phase system (i.e. motor) in different reference systems (abc, $\alpha\beta$, dq); PI regulators; Hysteresis regulators; predictive control; compensation of dq coupling terms. Controlo of an Induction machine fed from Current Source Inverter. Space Vector PWM and a.c. current control Inverter configurations, voltage reference and basic principles of the method, limit voltage exagon and overmodulation, optimal sequence of inverter states, switching frequency and current ripple; effect of dead-times and common mode voltage. Active Front-End Converter: block diagram and basic operation. Open- and closed-loop control; current control on different reference frames with linear (PI) and hystereisi regulators, voltage saturation, decoupled current control. Brushless Drives Use of Permanent magnets, different types of rotor design and rotor saliency, elctromagnetic force induced on the stator windings (d.c. and a.c. BL), effect of saliency on torque; cogging; regulation schemes; steady-state operation and geometrical loci in the field-weakening region. BL with prapezoidal cemf: current waveforms and torque ripple.
Metodi didattici	Lectures (hours/year in lecture theatre): 62 Practical class (hours/year in lecture theatre): 48 Practicals / Workshops /Seminars (hours/year in lecture theatre): 4
Testi di riferimento	In the following a list of taxtbooks related to ED is presented. Additional material (notes, links, papers and so on) will be given during lectures. Please refre to KIRO Portal.

	Legnani, Tiboni, Adamini. Meccanica degli Azionamenti vol. 1 - Azionamenti Elettrici. Progetto Leonardo, Bologna, 2002. W. Leonhard. Control of Electrical Drives. Springer Verlag, 1998. Bimal K. Bose. Power Electronics and Variable Frequency Drives. Technology and Applications. IEEE Press, 1997. Mohan, Undeland, Robbins. Elettronica di potenza. Convertitori e applicazioni. Hoepli, Milano, 2005. Murphy, Turnbull. A.C. current control. Pergamon Press,1988. L. Bonometti. Convertitori di potenza e servomotori brushless. UTET 2001.
Modalità verifica apprendimento	Oral exam during which the students can be required to solve a simple written exercise on the very basic contents of the course. A written relation on specific subjects and the interest displayed during the lectures can also contribute to the evaluation
Altre informazioni	
Obiettivi Agenda 2030 per lo sviluppo sostenibile	$lbl_legenda_sviluppo_sostenibile