Università degli Studi di Roma "Tor Vergata"

Facsimile Scheda Insegnamento

Mod. Scheda Insegnamento v. 1.1

Docente responsabile dell'insegnamento/attività formativa

Nome	Cristiano Maria
Cognome	Verrelli

Denominazione insegnamento/attività formativa

Italiano	
Inglese	Control of Electrical Motors and Vehicles

Informazioni insegnamento/attività formativa

A.A. 2025/26 ○ L ◉ LM ○ LM CU

CdS	Mechatronics Engineering
Codice	
Canale	
CFU	6
Lingua	Inglese

Docente del modulo didattico (compilare solo per attività formative articolate in moduli)

Nome	
Cognome	

Denominazione modulo didattico (compilare solo per attività formative articolate in moduli)

Italiano	
Inglese	

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Facsimile Scheda Insegnamento

Obiettivi formativi e risultati di apprendimento attesi

Italiano	
Inglese	LEARNING OUTCOMES: Theory of nonlinear differential equations to be used to gain profound insight into the fundamental mathematical modeling and control design techniques for electrical machines with application to electrical vehicles. KNOWLEDGE AND UNDERSTANDING: Students are envisaged to understand how to manage nonlinear differential equations for analysis and control design purposes. Indeed, electrical machines exhibit many typical and unavoidable nonlinear features and so the material presented in this self contained course will be of value not only to engineers engaged in the control of electric machines but also to a broader audience interested in (nonlinear) control design. APPLYING KNOWLEDGE AND UNDERSTANDING: Students are envisaged to apply broadly and to personalize the design techniques and algorithm approaches taught during the lessons. Tutor-guided individual projects (including computer simulations and lab experiments) invite an intensive participation. MAKING JUDGEMENTS: Students are envisaged to provide a personal description of the

Prerequisiti

Italiano	
Inglese	Preliminary knowledge of mathematical analysis, differential equations, and linear algebra is required.

Programma

Italiano	
Inglese	1. Electrical machines (types and operating principles). 2. Modeling of electrical machines and letter swap. 3. DC motor control. 4. Torque-speed characteristics for induction motors. 5. Field oriented control for induction motors. 6. Flux observation (and parameter identification) for induction motors. 7. Sensorless control for induction motors. 8. Field oriented control for (surface) Permanent Magnet Synchronous Motors. 9. Sensorless control for Permanent Magnet Synchronous Motors. 10. Control of Interior Permanent Magnet Synchronous Motors. 11. Repetitive Control for Permanent Magnet Step Motors. 12. Applications to robot control, control implementation issues. 13. Cruise control for electric vehicles (with generation of motor speed references). 14. Cruise control for electric vehicles in-wheel motors under slip constraints.

Modalità di valutazione

- ☐ Prova scritta
- ☒ Prova orale
- ☒ Valutazione in itinere
- ☒ Valutazione di progetto
- ☐ Valutazione di tirocinio
- ☐ Prova pratica
- ☐ Prova di laboratorio

Descrizione delle modalità e dei criteri di verifica dell'apprendimento

Italiano	
Inglese	a) Combination of: seminars and oral exam. b) Two seminars are to be carried out by students on specific topics of the course. The oral exam involves questions regarding a paper from the literature as well as the use of softwares for motor and vehicle simulation. The seminars and the oral concur almost evenly to the final score (x/30). c) The final score is based on the level of knowledge of the theoretical, design and algorithm elements and tools; in particular, the final evaluation refers for 70% to the students knowledge level and for 30% to her/his capability of expressing the knowledge and providing an autonomous judgment in the design and oral exam phases. The detailed final evaluation criteria are as follows:

Testi adottati

Italiano	
Inglese	[1] R. Marino, P. Tomei, C.M. Verrelli, Induction Motor Control Design, Springer. [2] Papers from the scientific literature. [3] C.M. Verrelli, Linear Control Design for Linear Systems. A Primer, Esculapio. [4] C.M. Verrelli, Linear Control Design for Linear Systems. Practice book, Esculapio.

Bibliografia di riferimento

Italiano	
Inglese	

Modalità di svolgimento

- [x] Modalità in presenza
- [ ] Modalità a distanza

Descrizione della modalità di svolgimento e metodi didattici adottati

Italiano	
Inglese	Lessons take place in a classroom equipped for both slide projection and blackboard-based activities. Lessons include both theoretical topics and design activities as well as exercise sessions on the various topics of interest for the design.

Modalità di frequenza

- ( ) Frequenza facoltativa
- (•) Frequenza obbligatoria

Descrizione della modalità di frequenza

Italiano	
Inglese	Class participation envisages also an active and interactive involvement of students.