Filippo Savi

Nazionalità: Italiana

Sesso: Maschile

CONTATTI

europass

ESPERIENZA LAVORATIVA

2012 – 2013 Parma, Italia

Progettista elettronico UNIPR Racing Team

-Progettazione di una centralina con funzioni ADAS (traction control, ESP, laun
veicolo (controllo cambio sequenziale)

2013 – 2015 Parma, Italia

Project Manager UNIPR Racing Team

-Gestione sviluppo di una piattaforma espandibile, ad alta potenza di calcolo p
centraline di controllo a bordo del veicolo

15/05/2017 – 14/05/2018 Parma, Italia

Borsa di ricerca Università degli studi di parma

-Progettazione di un Inverter basato su tecnologie wide bandgap per il pilotagg
rotazione

29/02/2020 – 31/10/2020 Modena, Italia

Assegno di ricerca Università degli studi di modena e reggio emi

-Attivita' di ricerca in ambito di Convertitori DC-AC ad alta frequenza di commu
-Progettazione e realizzazione di un sistema di controllo basato su FPGA per co
prestazioni

01/11/2021 – 14/12/2022 Modena, Italia

Assegno di ricerca Università degli studi di modena e reggio emi

-Attivita' di ricerca in ambito di Convertitori DC-DC ad alta frequenza di commu
-Sviluppo di un sistema di controllo basato su FPGA per convertitori statici ad a

15/12/2022 – ATTUALE Modena, Italia

Ricercatore universitario Università degli studi di modena e reg

-Attivita' di ricerca in ambito di Convertitori DC-DC ad alta frequenza di commu

ISTRUZIONE E FORMAZIONE

2010 – 2013 Parma, Italia

Laurea in ingegneria informatica Elettronica e delle telecomu
studi di parma

Livello EQF Livello 6 EQF

2014 – 2016 Parma, Italia

Laurea magistrale in ingegneria elettronica Università degli st

Livello EQF Livello 7 EQF

25/08/2017 – 21/10/2021

Doctor of Philosophy University of Nottingham, Ningbo China

Livello EQF Livello 8 EQF

COMPETENZE LINGUISTICHE

LINGUA MADRE: italiano

Altre lingue:

inglese

Ascolto C1
Lettura C1
Scrittura C1
Produzione orale C1
Interazione orale C1

francese

Ascolto B1
Lettura B1
Scrittura B1
Produzione orale B1
Interazione orale B1

Livelli: A1 e A2: Livello elementare B1 e B2: Livello intermedio C1 e C2: Livello avanzato

ULTERIORI INFORMAZIONI

Pubblicazioni

Information Technologies for Distributed Machine Drives: An Overview 2019

The exponential growth experienced by the semiconductor manufacturing field has led to a large proliferation of devices with large amounts computational power, enabling countless technologies and revolutionizing many fields. Control systems and machine drives are certainly among them. Much research is being carried out to develop multi-phase and fully segmented machines, with their inherent fault tolerance. To take full advantage of the redundancy and load sharing capabilities of the machine structure, with multiple winding sets, a suitable distributed control method must be used. A high performance network between the drives is thus required. This paper will present an overview of the available communication protocols that are used in the field and evaluate how suitable are they to this new class of very demanding real time tasks.

DOI: 10.1109/IEMDC.2019.8785232

Multiphase fault tolerant distributed control techniques for integrated drives based on resonant regulators

2020

One of the challenges brought forward by the gradual electrification undertaken by the aviation sector is the requirement of fault tolerance for machine drive systems to be used for critical on-board tasks such as propulsion or primary flight surface actuation. Their inherent advantages in both volumetric and gravimetric power density makes integrated drives the prime candidates for these applications. Despite the large advances in this field, few key area still need work. Key among which is fault tolerant current control strategies. This paper studies the application of resonant control techniques to achieve a scalable and fault tolerant current control strategy for multiphase machine.

DOI: 10.1109/IECON43393.2020.9254985

High-Speed Electric Drives: A Step Towards System Design 2020

Electric drives applications have been worldwide adopted for the transportation electrification. An electric drive system is constituted by two main components: the power electronics converter and the electrical machine. Traditionally the design workflow consisted in the separate realization of these two parts, by different teams or even organizations. This requires strong assumptions regarding operating conditions and may lead to actual performance at system level far from the one expected. In this article, a unified design methodology of the two sub-systems is presented considering the true operating conditions, allowing a more accurate assessment of power losses at system level and identifying the influence of the converter design choices on the electric machine performance. As a case study, this article presents a comparative analysis among three different converter topologies designed to drive a 8.5 kW-120 krpm surface PMSM. The study aims at comparing the considered systems in terms of overall efficiency, losses distribution and system complexity. At first converters are simulated in Matlab-Simulink to estimate the losses and the current waveforms, that are then used in the Finite Element model of the electrical machine to estimate the loss components in a real scenario. The models developed are then validated by means of experimental measurements. This article highlights the new understanding that can be gained by considering the interactions between sub-systems, allowing a more conscious choice of the converter topology to achieve optimal overall performance.

DOI: 10.1109/OJIES.2020.2973883

Wide Bandgap Voltage Source Inverter Design for Automotive Electric Drivetrain 2018

In this paper a high power, high frequency voltage source inverter for automotive traction application is reviewed. The main objectives of the design process is the maximization of power density, while keeping high efficiency and low weight. In this paper, the focus is placed on the peculiarities that differentiate this

design from other ordinary machine drive. In particular several areas are explored, all equally important for the achievement of design goals. Starting from device choice to gate driving and current sensing circuits design.

DOI: 10.1109/ESARS-ITEC.2018.8607561

A system level comparison of drive topologies for high speed electrical machines 2017

This paper presents a comprehensive comparative study among five different converter topologies all designed to drive a 8.5kW-120krpm surface permanent magnet synchronous machine. The study aims at comparing the considered systems in terms of converter complexity, control complexity and overall efficiency. The assessment of the subsystems' efficiencies is based on a set of decoupled converter-electrical machine simulations. First the designed converters are simulated in Matlab-Simulink environment in order to estimate the converter losses and the current waveforms. Then the latter are used to supply the Finite Elements(FE) model of the electrical machine so to estimate all the loss components present in the real scenario. The results of the carried out study gives a wide understanding of the interaction between the two subsystems and some general design considerations needed to select the converter topology.

DOI: 10.1109/IECON.2017.8216750

A simple and accurate algorithm for speed measurement in electric drives using incremental encoder

2017

Incremental encoders and their use in electric drives are nowadays considered standard and not given much thought. Nevertheless, speed measurement through the signals coming from an incremental encoder can be subject to errors in some operating conditions if special care is not taken. Techniques exist in literature to enhance the precision of speed measurement, but they often require special hardware (i.e. FPGA) or a non-negligible portion of computing power. This paper proposes a novel technique for precise speed measurement, with minimal error, that can be implemented on a low-cost microcontroller with standard quadrature decoder peripheral.

DOI: 10.1109/IECON.2017.8216793

femtoCore: An Open Source Processor Architecture for Power Electronics Controls 2022

The flexibility, high performance and determinism of Field Programmable Gate Array (FPGA), makes them an ideal candidate for the digital control of power electronics converters. This is especially true when dealing with modular and multi-phase systems where large numbers of PWM signals and dedicated custom communication interfaces are a requirement. This paper brings forward a novel, floating point processor architecture that marries for the development speed typical of software workflows, with strong safety guarantees that fully deterministic HDL workflow can offer.

DOI: 10.30420/565822225

Evaluation of Inverter Architectures for Output Voltage Overshoot Reduction in WBG Electric Drives

The electrification of Non Road Mobile Machinery (NRMM) has brought to light several challenges for electrical actuation systems currently in use, above all their low power density. To hit the required targets, a strong increase of the performance, for both machines and drives, will be required. On the power electronic side, wide bandgap devices promise to enable much higher operating frequencies and temperatures, that can drastically cut down on the size of heatsinks and all magnetic components. However, their fast transition times produce an increased electric stress on the stator insulation system, which can experience partial discharges in some cases, thus quickly degrading. This paper strives to thoroughly compare several drive architectures that can mitigate this challenge, guiding the topology choice by analyzing power efficiency, ability to limit or eliminate overvoltages, reliability of the inverter structure and costs

DOI: 10.1109/ISIE45552.2021.9576218

SEPIC and Flyback Converters for Isolated Photovoltaic Battery Charging Application

The paper shows the idealized performance and a design methodology for the isolated version of the SEPIC DC/DC converter, including a non-dissipative snubber. This paper compares the use of a Single-Ended Primary-Inductor Converter (SEPIC) and a flyback converter as Photovoltaic (PV) charge controllers for battery charging applications. A simulation based study is also presented, comparing key performance metrics, like efficiency, input voltage and output current ripple, between the proposed architecture and an industry-standard flyback converter.

DOI: 10.1109/eGRID52793.2021.9662142

Femtocore: An Application Specific Processor for Vertically Integrated High Performance Real-Time Controls

In applications that require a high availability and high performance (for example aerospace),modular power electronics and multi-phase machines represent an advantageous choice. In this framework, a

control system able to handle a high number of PWM signals and communication interfaces as well as featuring a high computational power is required. This paper proposes a novel HDL plus soft-core approach to be implemented on System-on-Chip hardware which allows for the efficient and modular implementation of the modern control techniques with strong guarantees in terms of determinism. The proposal lies in the adoption of a very simplified and optimized floating-point soft-core, the femtocore (fCore) and its tool-chain, which allows C-like implementation of complex algorithms in a HDL-design power electronics control framework. Several fCore units can be arranged for parallel processing to handle the time requirements of a complex modular system even with low sampling time (100 kHz or more). The proposed architecture is experimentally validated in a proof-of-concept, six-phase electric machine including a comparison against a traditional method.

DOI: 10.1109/OJIES.2021.3112124

Minimization of network induced jitter impact on FPGA-based control systems for power electronics through forward error correction

n modular distributed architectures, the adoption of a communication method that is at the same time robust and has a low and predictable latency is of utmost importance in order to support the required system dynamics. The aim of this paper is to evaluate the consequences of the random jitter on machine drives distributed control, caused by the messages' re-transmission in case of an error in the received data. To achieve this goal, two different Forward Error Correction (FEC) techniques are introduced in the chosen protocol, so that the recipient of the message can correct random errors without the need of any additional round trip delays needed to request and obtain a re-transmission. Experimentally validated simulations are used to evaluate the impact of random network derived jitter on a real world closed loop control system for distributed power electronic converters.

DOI: 10.3390/electronics9020281

A Scalable System Architecture for High-Performance Fault Tolerant Machine Drives

When targeting mission critical applications, the design of the electronic actuation systems needs to consider many requirements and constraints not typical in standard industrial applications. One of these is tolerance to faults, as the unplanned shutdown of a critical subsystem, if not handled correctly, could lead to financial harm, environmental disaster, or even loss of life. One way this can be avoided is through the design of an electric drive systems based on multi-phase machines that can keep operating, albeit with degraded performance, in a partial configuration under fault conditions. Distributed architectures are uniquely suited to meet these challenges, by providing a large degree of isolation between the various components. This paper presents a system architecture suitable for scalable and high-performance fault tolerant machine drive systems. the effectiveness of this system is demonstrated through theoretical analysis and experimental verification on a six-phase machine.

DOI: 10.1109/OJIES.2021.3104977

Competenze professionali

Competenze professionali

- Padronanza di tutte le fasi di progetto e realizzazione di un circuito stampato: studio di fattibilità, definizione dei requisiti, progettazione del circuito e della scheda stampata, realizzazione fisica del primo prototipo
- Ottima conoscenza della tecnica di saldatura a stagno, sia con componenti trdizionali per montaggio su foro che a montaggio superficiali
- Conoscenza delle principali tecniche di ottimizzazione dei progetti elettronici, secondo le regole del Design For Manifacturing(DFM) che permette di ridurre i costi di produzione su larga scala
- Pardonanza del flusso di lavoro della programmazione di microcontrollori, in linguaggio C/C++, in particolare con riferimento all'architettura ARM Cortex M
- Design di sistemi di controllo basati su Field Programmable Gate Array (FPGA) e System on Chip (SoC) a tecnologia mista FPGA+CPU
- Definizione "Full stack" di archtetture per sistemi di controllo real time distribuiti, a partire dai requisiti hardware fino ai componenti software di alto livello
- Sviluppo di sistemi software su distribuzioni linux customizzabili

Autorizzo il trattamento dei miei dati personali presenti nel CV ai sensi dell'art. 13 d. lgs. 30 giugno 2003 n. 196 - "Codice in materia di protezione dei dati personali" e dell'art. 13 GDPR 679/16 - "Regolamento europeo sulla protezione dei dati personali".