

SAPIENZA – UNIVERSITA' DI ROMA

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RESEARCH TOPICS

- Low-Cost, High-Resolution, Fault-Robust Position and Speed Estimation for PMSM Drives Operating in Safety-Critical Systems
- Rotor torsional resonance detection in induction drives by MCSA and RSHs
- Permanent magnet linear actuators for ship rudder direct drives
- Condition monitoring of electric vehicle drivetrain components
- Distributed generation based on renewable energy sources

LOW-COST, HIGH-RESOLUTION, FAULT-ROBUST POSITION AND SPEED ESTIMATION FOR PMSM DRIVES OPERATING IN SAFETY-CRITICAL SYSTEMS

Keywords: Safety, Redundancy, Fault tolerance, Hall-effect, Signal injection, Resolution

Aim of the research is to obtain a low-cost, high-resolution and fault-robust position sensing system for permanent magnet synchronous motor drives operating in safety-critical systems, by combining binary Hall-effect sensors with high-frequency signal injection. The resulting algorithm provides accurate, high-resolution estimates of speed and position throughout the entire speed range; compared to state-of-the-art drives using Hall-effect sensors alone, the low speed performance is greatly improved in healthy conditions and also following position sensor faults. It is envisaged that such a sensing system can be successfully used in applications requiring IEC 61508 SIL 3 or ISO 26262 ASIL D compliance, due to its extremely high mean time to failure and to the very fast recovery of the drive following Hall-effect sensor faults at low speeds.

References

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ROTOR TORSIONAL RESONANCE DETECTION IN INDUCTION DRIVES BY MCSA AND RSHs

Keywords: Bar breakage, end ring, fabricated cage, fault detection, harmonic torque, induction motor, railway drive, rotor slot harmonics, torsional resonance, vibration

Non invasive detection of large speed fluctuations (especially under torsional resonance conditions) can be carried out in induction drives by MCSA, exploiting the amplitude variation of the rotor slot harmonics (RSHs). RSHs are useful for *average speed estimation*, but this research instead focuses on *speed fluctuations*.

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PERMANENT MAGNET LINEAR ACTUATORS FOR SHIP RUDDER DIRECT DRIVES

Keywords: Direct drive, efficiency, full-electric drive, hydraulic drive, permanent magnet linear motor, mechanical analysis, thermal analysis

Research on high thrust permanent magnet linear direct drives for actuation of ship loads, in replacement of classical oil rams.

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CONDITION MONITORING OF ELECTRIC VEHICLE DRIVETRAIN COMPONENTS

Keywords: Condition monitoring, Reliability, Electric vehicles, Semiconductors

The aim of the research is to improve the condition monitoring of electric vehicle drivetrain components, to support the development of condition monitoring methods that are directly applicable to current and future electric and hybrid electric vehicles. The research is object of a COST Action proposal.

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DISTRIBUTED GENERATION BASED ON RENEWABLE ENERGY SOURCES

Keywords: Photovoltaic panel, Wind turbine, Maximum Power Point Tracking, Permanent magnet synchronous machines, Stand-alone power systems, Grid-connected power systems, Renewable energy sources, Smart grids

The research aims to investigate a wide range of small- and medium-size generators based on renewable energy sources for both standalone and grid-connected power systems. Thanks to the expertise of Sapienza group in this field, it participates in an Erasmus+ Project (e-Academy to support Smart Cities Operations in Palestine – eSCO, 2018-2020), as the partner responsible for the section "Power Systems".

References

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