Technical Presentation Session
Sponsored by IAS Young Professionals and Alumni of CMD

Keynote Lecture

Induction motor condition monitoring via current analysis: classical methods (MCSA) vs. modern transient-based technologies (ATCSA)
Power Point Presentation

Jose Antonino-Daviu (S'04-M'08-SM'12) was born in Valencia, Spain, in 1976. He received his M.Sc. and Ph. D. degrees in Electrical Engineering, both from the Universitat Politècnica de València, Valencia, Spain in 2000 and 2006, respectively and the Ms. Degree in Business Administration and Management from the Universitat de València, Valencia, Spain, in 2012. He worked for IBM, being involved in several international projects. He is currently Associate Professor in the Department of Electrical Engineering of the Universitat Politècnica de València, where he develops his docent and research work. He is also Secretary of the mentioned Department.

His primary research interests are condition monitoring of electric machines, signal processing and its application to fault diagnosis as well as design and optimization of electrical installations and systems. His main achievement is the development of techniques for the reliable diagnosis of the rotor condition in electric motors; these innovative techniques rely on the analysis of machine's currents during transient operation. He has been invited professor in Helsinki University of Technology (Finland) in 2005 and 2007, Michigan State University (USA) in 2010, Korea University (South Korea) in 2014, Université Claude Bernard Lyon 1 (France) and Coventry University (2016). He has taught seminars in several Universities all over the world, such as AGH University of Science and Technology of Krakow (Poland), Helsinki University of Technology (Finland), Michigan State University (USA), University of Korea (South Korea), Université Claude Bernard Lyon 1 (France),Coventry University (U.K.). Moreover, he has established important collaborations with important companies where his techniques have been applied. He has taught technical courses for international companies as BASF DE (Germany), GENERAL ELECTRIC (Europe), KARSTEN MOHOLT (Norway), REPSOL (Spain)...and given technical talks in many other companies (SABIC (Netherlands), BRITISH PETROLEUM (Spain), UBE CHEMICAL (Spain), FYM ITALCEMENTI (Spain). He is co-author of more than 200 papers published in technical journals (>80 papers) and conference proceedings (>120). He is also co-author of 1 international patent. These works have received more than 4400 citations to his works. Since 2012,

he is IEEE Senior Member. He is Associate Editor of IEEE transactions on Industrial Informatics, IEEE Industrial Electronics Magazine and IEEE Journal of Emerging and Selected Topics in Industrial Electronics. He has been special session organizer as well as session chair in different IEEE conferences (IECON, ICEM, ICELIE, INDIN...) and he acts as reviewer for several IEEE journals as well as for other international publications. He was recipient of the IEEE Second Prize Paper Award of the Electric Machines Committee of the IEEE Industry Applications Society. He was also awarded with the Best Paper Award in the conferences IEEE ICEM 2012 and IEEE SDEMPED 2011 and he was awarded with the 'Highly commended recognition' of the IET Innovation Awards in 2014 and in 2016. He has been general co-chair of IEEE SDEMPED 2013 and is member of the Steering Committee of IEEE SDEMPED and of ICEM.

In 2016, he was awarded with the 'Medal of the Spanish Royal Academy of Engineering' for his contributions in new techniques for predictive maintenance of electric motors (2016). In 2018, he received the Nagamori Award (Kyoto, Japan) for his work in transient analysis applied to electric motors. In 2019, he obtained the SDEMPED Diagnostic Achievement Award (Toulouse, France) for his works in condition monitoring of electric motors.

Abstract: The analysis of motor currents is one of the most widespread techniques in industry for determining the condition of induction motors. The classical method relies on the analysis of steady-state currents of the machine (Motor Current Signature Analysis, MCSA) and has been applied over decades with rather good results. However, over recent years, some authors have reported important drawbacks of MCSA, such as the occasional occurrence of false indications or its unsuitability under variable speed conditions. To overcome them, new methods based on the analysis of transient signals such as the startup current (Advanced Transient Current Signature Analysis, ATCSA) have been introduced. This lecture is intended to explain in detail the different available current-based fault diagnosis approaches, including the classical tools (MCSA) and the recent methodologies (ATCSA). The foundations of MCSA will be detailed, characterizing the different harmonics that should be present both in healthy and faulty conditions. Afterwards, drawbacks of MCSA will be described. Finally, foundations of ATCSA will be accurately explained and its different variants commented. All the explanations will be supported by real cases related to industrial motors of different sizes.

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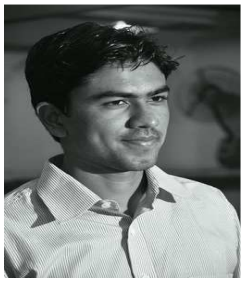
Lectures of IAS YPs and CMD Alumni

Characteristic Analysis of Demagnetization Faults in Surface Mounted Permanent Magnet type BLDC Motors

Power Point presentation , 45 min



Adil Usman, PhD, SMIEEE, Research Associate, Indian Institute of Technology Mandi, India |Chair IEEE MGA SAC-SPAx 2020|Member IEEE IAS-EMC Committee| IEEE PES YP Representative India

Biography: Dr. Adil Usman (S'10–M'19–SM'20) has been conferred with an award of PhD degree from Indian Institute of Technology (IIT) Mandi, India. His research areas of interests include Condition Monitoring of Electrical Machines, Battery Management System (BMS) in Hybrid Electric Vehicles (HEVs) and Global Humanitarian Challenges. He is an active volunteer of IEEE for more than a decade and holds several responsibilities in the capacity of IEEE MGA Student Professional Awareness (SPAx) Chair for Region 1-10. He is currently a Young Professional Representative from India for Power & Energy Society (PES-YP) and is a Member of Electrical Machinery Committee (EMC) of both IAS and PES societies. Having a diverse interest in Environmental Sustainability, he holds many parallel ongoing projects worldwide which includes Climate Change Mitigation, Internet of Things (IoT) for Indian farmers, Solid Waste Management (SWM), Disaster Risk Management and Smart Village leveraging in Himalayan regions of India. In addition, he is currently looking over the IEEE PES Smart Village Operations in India, Cameroon, and Peru.

Abstract: - Surface Mounted Permanent Magnet (SPM)- type Brushless Direct Current (BLDC) motor is more prominent in industries due to its emerging applications in Electric Vehicles (EVs). The SPM-type BLDC motors are characterized with compact structure, high torque density, high efficiency and high dynamic performance which makes it suitable to be deployed for high precision-controlled applications. However, during the continuous operation of the BLDC motors in industries, they are subjected to environmental, physical and thermal stress which can give rise to the emergence of faults. Fault can manifest into electrical quantities like current and/or voltage, magnetic quantities like flux (ϕ), acoustic noise and vibrations and thermal characteristics (ΔºT) of the machine which can ultimately lead to the complete failure of the system. The fault in Brushless PM motors can either be in the stator windings which is generally termed as Stator Winding Fault (SWF) while on the rotor side it could be demagnetization of rotor PMs. The proposed research however focuses in modeling the demagnetization effects of rotor PMs for Brushless PM Synchronous Motor or BLDC motor using a novel modeling approach. The effect of demagnetization faults in the rotor PMs is studied under subjected conditions viz. uniform demagnetization of a PM, physical defects in rotor PMs and extremely demagnetized PM in a machine. The proposed modeling approach is found to be feasible for an online condition monitoring based system which determines the State of Health (SOH) of a machine based on motor back-EMF and magnetic flux signatures.