

2019 9th International Electric Drives Production Conference (EDPC 2019)

**Esslingen, Germany
3 – 4 December 2019**



**IEEE Catalog Number: CFP1985P-POD
ISBN: 978-1-7281-4320-0**

**Copyright © 2019 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP1985P-POD
ISBN (Print-On-Demand):	978-1-7281-4320-0
ISBN (Online):	978-1-7281-4319-4

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

Table of contents

1.	Winding Technologies – Round Copper Wire	
1.1	Feasibility Study for Enamelled Round Copper Wire Compression within Slots of Electrical Machines Dr. Sell-Le Blanc F., Weisse L., Aumann Espelkamp GmbH (DE).....	3
2.	Manufacturing of Rotors	
2.1	Sensitivity Analysis and Validation of the Intelligent Assembly Process for Permanent Magnet Rotors with the Balancing Grade G 2.5 Woessner W., Karlsruhe Institute of Technology (KIT) (DE).....	15
2.2	Comparison of Additive Balancing Processes for Rotors in the Context of High Speed Electric Traction Motors Masuch M., Friedrich-Alexander University of Erlangen-Nuremberg (FAU) (DE)	21
3.	Industry 4.0 Applications	
3.1	Machine Learning in Electric Motor Production – Potentials, Challenges and Exemplary Applications Mayr A., Friedrich-Alexander University of Erlangen-Nuremberg (FAU) (DE)	31
3.2	Quality Modelling in Battery Cell Manufacturing Using Soft Sensing and Sensor Fusion – A Review Wanner J., Institute for Energy Efficiency in Production (EEEP) (DE)	41
3.3	Fault Classification and Correction Based on Convolutional Neural Networks exemplified by Laser Welding of Hairpin Windings Vater J., BMW Group (DE)	51
4.	Winding Technologies – Shaped Copper Wire	
4.1	Manufacturing Influences on the Motor Performance of Traction Drives with Hairpin Winding Glaessel T., Friedrich-Alexander University of Erlangen-Nuremberg (FAU) (DE)	61
4.2	Influence of Wire Tolerances on Hairpin Shaping Processes Wirth F., Karlsruhe Institute of Technology (KIT) (DE)	69
5.	Testing Technology for PM Rotors	
5.1	Investigation of the Measurability of Magnet Quality for IPM Rotors by Using an Opposing Field and a Rotor Scan System Schwarzer D., TU Berlin (DE)	79

6.	Simulation Based Optimization of Electric Motors	
6.1	Air Gap Influence in Axial Flux Machines with Different Excitation Schwarz P., TU Ilmenau (DE)	87
7.	Winding Technologies – Advances in Manufacturing Processes	
7.1	Validation of a Bending Simulation Models Based on the Yield Strength Influences of Electrical Steel Sheets on Stator Core Radius Wueterich D., SEG Automotive Germany GmbH (DE)	95
7.2	Resource-Efficient, Innovative Coil Production for Increased Filling Factor Bach M., Fraunhofer-Institute of Machine Tools and Forming Technologies Chemnitz (DE)	101
7.3	Development of a New Model Based Servo-Controlled Wire Tensile Force Control for Stator Winding Applications Hofmann J., Karlsruhe Institute of Technology (KIT) (DE)	107
9.	Power Electronics & Control Methods	
9.1	User-Oriented Control of a Drive System over the Whole Operating Range Ketterer C., Robert Bosch GmbH (DE).....	115
9.2	Effects of Fast Switching Semiconductors Operating Variable Speed Low Voltage Machines Kilper M., Daimler AG (DE)	121
11.	Linear Actuators	
11.1	Improved Thermal Behavior of an Electromagnetic Linear Actuator with Different Winding Types and the Influence on the Complex Impedance Reissenweber L., Coburg University of Applied Sciences and Arts (DE).....	131
11.2	Digital Twin of the Linear Winding Process Based on Explicit Finite Element Method Weigelt M., Friedrich-Alexander University of Erlangen-Nuremberg (FAU) (DE).....	137
12.	Manufacturing of Laminated Stacks	
12.1	Influence of Cutting Tool Wear on Core Losses and Magnetizing Demand of Electrical Steel Sheets Regnet M., Technical University of Nuremberg GSO (DE).....	147
12.2	Series Production Challenges of High-Efficient Flux Barrier Permanent Magnet Machines (FB-PMSM) Dr. Greifelt A., FEAAM GmbH (DE).....	153

13.	Insulation Technologies II	
13.1	Systematic Investigation of the Grooving Process and its Influence on Slot Insulation of Stators with Hairpin Technology Mayer D., Karlsruhe Institute of Technology (KIT) (DE).....	161
14.	Preformed Concentrated Windings	
14.1	Manufacturing of Conically Shaped Concentrated Windings for Wheel Hub Engines by a Multi-Stage Upsetting Process Petrell D., RWTH Aachen University (DE).....	171
14.2	Design and Evaluation Methodology for Insulation Systems of Low Voltage Drives with Preformed Coils Pauli F., RWTH Aachen University) (DE).....	179
15.	Manufacturing of Magnetic Components	
15.1	Evaluation of Soft Magnetic Ferrosilicon FeSi 6.5 for Laser Beam Melting Urban N., Friedrich-Alexander University of Erlangen-Nuremberg (FAU) (DE).....	189
15.2	Potentials of Process Monitoring during Laser Welding of Electrical Steel Laminations Ziegler M., Friedrich-Alexander University of Erlangen-Nuremberg (FAU) (DE).....	193
16.	Insulation Technologies III	
16.1	Challenges in Electric Machine Stator Manufacturing and Their Influences on Thermal Performance Dr. Guo Y., University of Warwick (GB).....	201
17.	E-Mobility Concepts	
17.1	Comparison of Two Different Winding Sets for Dual Three-Phase Permanent Magnet Machines Keller D., Daimler AG (DE).....	213
17.2	Cost Optimal design Strategy of Electric Drivetrains for Medium Heavy-Duty Vehicles Based on Product Development and Production Costs Pandey R., Dorantes Gomez J. G., RWTH Aachen University (DE).....	219
17.3	Method for Capacity Planning of Changeable Production Systems in the Electric Drives Production Niemann J., BMW AG (DE)	227
18.	Innovative Electric Machine Design	
18.1	Aerospace Electric Generator Design Considerations Dr. Reinap A., Lund University (SE).....	235

18.2	Experimental and Simulation Study of Cooling System in Brush Less Direct Current (BLDC) Motor Controller for Electric Scooter Firdaus M. I., Center of Excellence for Automotive Control & System Institut Teknologi Sepuluh Nopember (ID).....	P 10
19. Poster-Sessions		
19.1	Knowledge-based Support of the Production System Design by Semantic Technologies Using the Example of the Electric Motor Production Mayr A., Friedrich-Alexander University of Erlangen-Nuremberg (FAU) (DE).....	251
19.2	Advances in Quality Monitoring of Stray Fields on Rotors of Permanent Magnet Synchronous Motors v. Lindenfels J., Friedrich-Alexander University of Erlangen-Nuremberg (FAU) (DE).....	257
19.3	Accelerated Production Ramp-up Utilising Clustering and Visualisation of Process Chain Interrelationships Meiners M., Friedrich-Alexander University of Erlangen-Nuremberg (FAU) (DE).....	263
19.4	Automated Optical Inspection of Soldering Connections in Power Electronics Production Using Convolutional Neural Networks Metzner M., Friedrich-Alexander University of Erlangen-Nuremberg (FAU) (DE).....	269
19.5	Coherences Between Production Technology and Performance of Electric Traction Drives Halwas M., Karlsruhe Institute of Technology (KIT) (DE).....	275