Matthias Preindl

Curriculum Vitae

April 10, 2019

Assistant Professor
Columbia University in the City of New York
Fu Foundation School of Engineering and Applied Science (SEAS)
Department of Electrical Engineering (EE)

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1 Education

Doctor of Philosophy (PhD)   awarded 03.2014
University of Padua, Doctoral School of Industrial Engineering, Specialization in Energy Engineering

Thesis: *"Novel Model Predictive Control of a PM Synchronous Motor Drive; Design of the Innovative Structure, Feasibility and Stability Analysis, Efficient Implementation, Experimental Validation,"* adviser: S. Bolognani

Visiting Scholar   02.2012 - 11.2012
University of California Berkeley, Department of Mechanical Engineering

Master of Science (MSc)   awarded 03.2010
Swiss Federal Institute of Technology (ETH) Zurich, Master Program in Electrical Engineering and Information Technology, Specialization in Electrical Energy Systems and Mechatronics

Thesis: *"Switching Frequency Reduction Using Sensorless Model Predictive Direct Current Control for High Power Voltage Source Inverters,"* adviser: E. Schaltz and J. W. Kolar

Visiting Student - MSc Thesis Project   07.2009 - 12.2009
Aalborg University (Denmark), Department of Energy Technology

Bachelor of Science (BSc)   *summa cum laude*, awarded 07.2008
University of Padua, Bachelor Program in Electrical Engineering

Thesis: *"Development of a Simulation Tool for the Halo Current Patterns on the First Wall of a Fusion Reactor,"* adviser: F. Gnesotto and G. Chitarin

Research Period - BSc Thesis Project   03.2008 - 06.2008
National Research Council (Padua, Italy), Consortium Reverse Field Pinch Experiment

High School Diploma   awarded 07.2005
Industrial Technical Institute (Gewerbeoberschule), Specialization in Industry Informatics

2 Appointments

2.1 Professional Appointments

Assistant Professor   since 01.2016
Columbia University, Department of Electrical Engineering (EE)

Sessional Professor   01.2015 - 06.2015
McMaster University, Department of Electrical and Computer Engineering (ECE)

Post Doctoral Research Associate   05.2014 - 12.2015
McMaster University, McMaster Institute for Automotive Research and Technology (MacAUTO)
Canada Excellence Research Chair in Hybrid Powertrain Program

Independent Contractor   01.2014 - 04.2014
BFT SpA, Italy

Graduate Research Assistant   10.2011 - 12.2013
University of Padua, Department of Industrial Engineering

R&D Engineer   03.2010 - 09.2012
Leitwind AG (Italy), Electrical Engineering Group

2.2 Board Memberships

Advisory Board Member   since 03.2019
Sinewatts Inc. (Start-up)

Advisory Board Member   since 10.2018
Tau Motors (Start-up)

2.3 Publishing, Editorial Board

Editor   since 10.2017
IEEE Transactions on Vehicular Technology

Associate Editor   since 11.2016
IEEE Transactions on Transportation Electrification

2.4 Roles at Columbia University

2.4.1 Department of Electrical Engineering (EE)

Motor Drives and Power Electronics Laboratory (MPlab)   since 01.2016
Founder and Director

EE Smart Electric Energy Research and Teaching Area   since 12.2017
Established the departmental *Smart Electric Energy Research Area*
Introduction and coordination of the *Smart Electric Energy* Concentration of the EE Master Program

EE Master Thesis   12.2018
Coordinated the introduction of a *Master Thesis* option for the EE Master Program

Electric Formula SAE (E-FSAE)   Student Club
Faculty adviser of the Columbia Knickerbocker Motorsports Formula SAE Electric team (since 09.2018)
Established a joint Electrical and Mechanical Department Formula SAE Electric team (09.2018)

2.4.2 Research Centers

Inaugural Core Faculty   since 01.2019
Columbia University, Columbia Electrochemical Energy Center (CEEC)

Core Faculty   since 09.2017
Columbia University, The Earth Institute, Lenfest Center for Sustainable Energy

Affiliated Faculty   since 09.2017
Columbia University, Data Science Institute, Sense, Collect and Move Data Center

3 Society Memberships

Institute of Electrical and Electronics Engineers (IEEE)
Senior member since 2018; Member 2014 - 2018; Student member 2012 - 2013

Südstern   Planet Science, Planet HiTech Engineering, Planet NYC & East Cost
Member since 2016

South Tyrolean student association (sh.asus)
Member 2005 - 2014; Organizing committee (Padua branch) 2007 - 2008 and 2011 - 2012

4 Awards and Honors

National Scientific Qualification (Habilitation) as Full Professor   11.2018
"Abilitazione scientifica nazionale, fascia 1, settore concorsuale 09/E2: ingegneria dell'energia elettrica"
According to Art.16 par.1, Law n.240/10, Ministry of Education, Universities and Research (MIUR), Italy

IEEE Senior Member Elevation   04.2018
Institute of Electrical and Electronics Engineers (IEEE)

National Scientific Qualification (Habilitation) as Associate Professor   03.2017
"Abilitazione scientifica nazionale, fascia 2, settore concorsuale 09/E2: ingegneria dell'energia elettrica"
According to Art.16 par.1, Law n.240/10, Ministry of Education, Universities and Research (MIUR), Italy

CAREER Award   02.2017
National Science Foundation (NSF)

South Tyrolean of the Day   28.12.2016
Südtirol 1 Radio, Italy

FUTURA Award   12.2016
FUTURA foundation, South Tyrol, Italy

Best Presentation Recognition   2015
Session: Transportation Electrification 1
Annual Conference of the IEEE Industrial Electronics Society (IECON)

PhD Fellowship (borsa di ateneo)   2012 - 2013
Granted by University of Padua, Italy

Postgraduate Fellowship   2011
Granted by Province Bozen, Italy

Award for outstanding achievements during academic studies   2011
Granted by Province Bozen, Italy

Best presentation award   2009
Conference for MSc Energy Students (CES), Aalborg University, Denmark

Merit scholarship for graduate students   2009, 2010
Granted by Province Bozen, Italy

Merit scholarship for undergraduate students   2007, 2008
Granted by Province Bozen, Italy

Youth tour guide (Jugendführer)   2006
Alpine association South Tyrol (Alpenverein Südtirol, AVS)

Youth musician merit badges   1999, 2002, 2004
Jungmusiker Leistungsabzeichen (JMLA) in bronze, silver, and gold; instrument: clarinet

5 Teaching Experience

5.1 Courses

Year	Number	Title	Enrollment	Course quality	Instructor quality
2018/19	E4906[2]	EV Drivetrain Lab	14	TBD/5.0	TBD/5.0
2018/19	E4361[2]	Power Electronics	21	4.09/5.0	4.09/5.0
2017/18	E6902[2]	Renewable Power Systems	14	4.00/5.0	4.00/5.0
2017/18	E9501[2]	Advanced Power Electronics	5	5.00/5.0	5.00/5.0
2017/18	E4361[2]	Power Electronics	19	4.57/5.0	4.71/5.0
2016/17	E6904[2]	Motor Drive Systems	9	4.60/5.0	4.60/5.0
2016/17	E4361[2]	Power Electronics	20	4.50/5.0	4.50/5.0
2015/16	E4361[2]	Power Electronics	16	4.75/5.0	4.75/5.0
2014/15	4PK4[1]	Power Electronics	71	N/A	N/A

Student evaluations, overall course and instructor quality (mean value): 1 - poor, 2 - fair, 3 - good, 4 - very good, 5 - excellent
[2] ELEN: Department of Electrical Engineering, Columbia University
[1] Elec Eng: Department of Electrical and Computer Engineering, McMaster University

5.2 Courses, Other Roles

Power Systems Analysis and Control   Spring 2018
ELEN E4511: Coordination and Mentoring of Adjunct Professor Damien Sciano
Department of Electrical Engineering, Columbia University, USA

Art of Engineering   Fall 2016, 6 lectures to 3h
ENGI E1102: Revisited freshmen electrical engineering projects
Department of Electrical Engineering, Columbia University, USA

5.3 Advising and Mentorship

5.3.1 PhD students: Thesis Supervision, Columbia University

Alan Li   since 09.2019

Liwei Zhou   since 09.2017
Recipient of the (merit based) Student Travel Grant, ECCE, 2018

Weizhong Wang   since 09.2016

William Michael Eull   since 09.2016
Preceptor, Mechatronics and Embedded Microcomputer Control (E4058), Mechanical Engineering, 2018
Recipient of the Presidential Distinguished Fellowship, Columbia University, 2016

Xiaoqing Yong   since 01.2016
Recipient of the Millman Teaching Assistant Award, Columbia University, 2017

5.3.2 PhD students: Thesis Co-Supervision, McMaster University

Ephrem Chemali   01.2015 - 03.2018
Thesis: *"Intelligent State-of-Charge and State-of-Health Estimation Framework for Li-ion Batteries in Electrified Vehicles using Deep Learning Techniques"*

Shamsuddeen Nalakath   09.2014 - 03.2018
Thesis: *"Robust Position Sensorless Model Predictive Control for Interior Permanent Magnet Synchronous Motor Drives"*
Nomination for the Governor General's Academic Medal

Yingguang Sun   09.2014 - 12.2016
Thesis: *"Unified Position Sensorless Solution with Wide Speed Range Capabilities for IPMSM Drives"*
Recipient of the Best Presentation Recognition in Modeling and Design of IPMSM, IECON, 2015

5.3.3 Visiting Scholars, Columbia University

Francesco Toso   04.2018 - 11.2018
Home institution: University of Padua, Italy

5.3.4 MSc students: Project Supervision, Columbia University

Nico Hoernle   spring 2018
Semester project: *"Battery Pack for an E-FSAE vehicle drivetrain"*

Jack Bott   2017/18
Semester project(s): *"Design and implementation of a smart motor control interface"*

Paul Young   2016/18
Semester project: *"Design and experimental validation of a soft-switching non-isolated DC-DC converter"*
MS EE Honors Program (2017), Columbia University
MS Armstrong Memorial Award (2018), Columbia University

Yao Song   summer 2016, semester project

5.3.5 MSc students: Thesis Co-Supervision, McMaster University

Bharat Agrawal   01.2015 - 06.2017
Thesis: *"Loss Minimization using Linear Soft-Switching with Wide Bandgap Devices in Efficient High-Frequency DC-DC Converters"*
Recipient of the Certificate of Excellence awarded for Outstanding Thesis, McMaster University, 2017
Recipient of the (merit based) Student Travel Grant, APEC, 2017

William Michael Eull   04.2014 - 08.2016
Thesis: *"Wide-bandgap three-phase inverter design with high power density"*

Lucas McCurlie   06.2014 - 08.2016
Thesis: *"Redistributive Non-Dissipative Battery Balancing Systems with Isolated DC/DC Converters: Theory, Design, Control and Implementation"*

5.3.6 BSc students, Columbia University

Max Moeller   spring 2018
Semester project: *"Battery Pack for an E-FSAE vehicle drivetrain"*

Dawei Ren, Ibrahima Niang, Albert Gao, Xuexin Wei   spring 2018
Senior project: "Electric Motor Drive for an E-FSAE vehicle drivetrain"

Amritha Sai Musipatla   fall 2016, semester project

6 Publications

6.1 Journal Papers

R. Rodriguez, **M. Preindl**, J. Cotton, and A. Emadi, "Review and trends of thermoelectric generator heat recovery in automotive applications," *IEEE Transactions on Vehicular Technology*, vol. PP, pp. 1–1, 2019. DOI: 10.1109/TVT.2019.2908150

E. Chemali, P. Kollmeyer, **M. Preindl**, and A. Emadi, "State-of-charge estimation of li-ion batteries using deep neural networks: A machine learning approach," *Journal of Power Sources*, vol. 400, pp. 242–255, 2018. DOI: 10.1016/j.jpowsour.2018.06.104

S. Nalakath, Y. Sun, **M. Preindl**, and A. Emadi, "Optimization-based position sensorless finite control set model predictive control for ipmsms," *IEEE Transactions on Power Electronics*, vol. 33, pp. 8672–8682, 2018. DOI: 10.1109/TPEL.2017.2784816

E. Chemali, P. Kollmeyer, **M. Preindl**, R. Ahmed, and A. Emadi, "Long short-term memory-networks for accurate state of charge estimation of li-ion batteries," *IEEE Transactions on Industrial Electronics*, vol. 65, pp. 6730–6739, 2018. DOI: 10.1109/TIE.2017.2787586

Y. Miao, H. Ge, **M. Preindl**, J. Ye, B. Cheng, and A. Emadi, "Mtpa fitting and torque estimation technique based on a new flux-linkage model for interior permanent magnet synchronous machines," *IEEE Transactions on Industry Applications*, vol. 53, pp. 5451–5460, 2017. DOI: 10.1109/TIA.2017.2726980

A. D. Callegaro, J. Guo, **M. Eull**, B. Danen, J. Gibson, **M. Preindl**, B. Bilgin, and A. Emadi, "Bus bar design for high-power inverters," *IEEE Transactions on Power Electronics*, vol. 33, pp. 2354–2367, 2018. DOI: 10.1109/TPEL.2017.2691668

M. Preindl, "A battery balancing auxiliary power module with predictive control for electrified transportation," *IEEE Transactions on Industrial Electronics*, vol. 65, pp. 6552–6559, 2017. DOI: 10.1109/TIE.2017.2682030

S. Nalakath, **M. Preindl**, and A. Emadi, "Online multi-parameter estimation of ipm motor drives with finite control set model predictive control," *IET Electric Power Applications*, vol. 11, pp. 944–951, 2017. DOI: 10.1049/iet-epa.2016.0514

Y. Sun, **M. Preindl**, S. Sirouspour, and A. Emadi, "Unified wide speed range ipm sensorless scheme using nonlinear optimization," *IEEE Transactions on Power Electronics*, vol. 32, pp. 6308–6322, 2017. DOI: 10.1109/TPEL.2016.2621064

L. McCurlie, **M. Preindl**, and A. Emadi, "Fast model predictive control for redistributive lithium ion battery balancing," *IEEE Transactions on Industrial Electronics*, vol. 64, pp. 1350–1357, 2017. DOI: 10.1109/TIE.2016.2611488

Y. Yang, B. Bilgin, M. Kasprzak, **S. Nalakath**, H. Sadek, **M. Preindl**, J. Cotton, N. Schofield, and A. Emadi, "Thermal management of electric machines," *IET Electrical Systems in Transportation*, vol. 7, pp. 104–116, 2017. DOI: 10.1049/iet-est.2015.0050

E. Chemali, **M. Preindl**, P. Malysz, and A. Emadi, "Electrochemical and electrostatic energy storage and management systems for electric drive vehicles: State-of-the-art review and future trends," *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 4, pp. 1117–1134, 2016. DOI: 10.1109/JESTPE.2016.2566583

M. Preindl, "Robust control invariant sets and lyapunov-based mpc for ipm synchronous motor drives," *IEEE Transactions on Industrial Electronics*, vol. 63, pp. 3925–3933, 2016. DOI: 10.1109/TIE.2016.2527722

B. Bilgin, P. Magne, P. Malysz, Y. Yang, V. Pantelic, **M. Preindl**, A. Korobkine, W. Jiang, M. Lawford, and A. Emadi, "Making the case for electrified transportation," *IEEE Transactions on Transportation Electrification*, vol. 1, pp. 4–17, 2015. DOI: 10.1109/TTE.2015.2437338

M. Preindl and S. Bolognani, "Optimal state reference computation with constrained MTPA criterion for PM motor drives," *IEEE Transactions on Power Electronics*, vol. 30, pp. 4524–4535, 2015. DOI: 10.1109/TPEL.2014.2354299

M. Preindl and S. Bolognani, "Model predictive direct torque control with finite control set for PMSM drive systems, part 2: Field weakening operation," *IEEE Transactions on Industrial Informatics*, vol. 9, pp. 648–657, 2013. DOI: 10.1109/TII.2012.2220353

M. Preindl and S. Bolognani, "Model predictive direct torque control with finite control set for PMSM drive systems, part 1: Maximum torque per ampere operation," *IEEE Transactions on Industrial Informatics*, vol. 9, pp. 1912–1921, 2013. DOI: 10.1109/TII.2012.2227265

M. Preindl and S. Bolognani, "Model predictive direct speed control with finite control set of PMSM drive systems," *IEEE Transactions on Power Electronics*, vol. 28, pp. 1007–1015, 2013. DOI: 10.1109/TPEL.2012.2204277

M. Preindl and E. Schaltz, "Sensorless model predictive direct current control using novel second-order PLL observer for PMSM drive systems," *IEEE Transactions on Industrial Electronics*, vol. 58, pp. 4087–4095, 2011. DOI: 10.1109/TIE.2010.2100331

M. Preindl, E. Schaltz, and P. Thøgersen, "Switching frequency reduction using model predictive direct current control for high power voltage source inverters," *IEEE Transactions on Industrial Electronics*, vol. 58, pp. 2826–2835, 2011. DOI: 10.1109/TIE.2010.2072894

M. Preindl and E. Schaltz, "Load torque compensator for model predictive direct current control in high power PMSM drive systems," *Journal of Energy and Power Engineering*, vol. 5, pp. 554–561, 2011

D. Testa, M. Toussaint, R. Chavan, J. Guterl, J. B. Lister, J. M. Moret, A. Perez, F. Sanchez, B. Schaller, G. Tonetti, A. Encheva, G. Vayakis, C. Walker, Y. Fournier, T. Maeder, A. Le-Luyer, P. Moreau, G. Chitarin, E. Alessi, R. S. Delogu, A. Gallo, N. Marconato, S. Peruzzo, **M. Preindl**, H. Carfantan, E. Hodgson, J. Romero, R. Vila, B. Brichard, and L. Vermeeren, "The magnetic diagnostic set for ITER," *IEEE Transactions on Plasma Science*, vol. 38, pp. 284–294, 2010. DOI: 10.1109/TPS.2009.2037226

6.2 International Conferences

L. Zhou and **M. Preindl**, "Variable-frequency explicit model predictive control of wide band gap dc/dc converter with critical soft switching," in *IEEE Applied Power Electronic Conference and Exposition (APEC)*, 2019

L. Zhou and **M. Preindl**, "Optimal-frequency critical soft switching method of synchronous dc/dc converter based on model predictive control," in *IEEE Applied Power Electronic Conference and Exposition (APEC)*, 2019

F. Toso, M. D. Soricellis, **M. Preindl**, and S. Bolognani, "Moving horizon estimator of pmsm nonlinearities," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2018. DOI: 10.1109/IECON.2018.8591775

D. F. Valencia, L. Sun, **M. Preindl**, and A. Emadi, "Convex optimization-based sensorless control for ipmsm drives with reduced complexity," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2018. DOI: 10.1109/IECON.2018.8591475

F. Toso, P. G. Carlet, **M. Preindl**, and S. Bolognani, "Active-flux-based motion-sensorless control of pmsm using moving horizon estimator," in *IEEE International Symposium on Sensorless Control for Electrical Drives (SLED)*, 2018. DOI: 10.1109/SLED.2018.8486107

X. Yong and **M. Preindl**, "Optimization-based position estimation of pm synchronous machine motor drives with magnetic saturation," in *IEEE International Symposium on Sensorless Control for Electrical Drives (SLED)*, 2018. DOI: 10.1109/SLED.2018.8486064

L. Zhou and **M. Preindl**, "Bidirectional transformerless ev charging system with low device cost and leakage current," in *IEEE Energy Conversion Congress and Exposition (ECCE)*, 2018. DOI: 10.1109/ECCE.2018.8558218

L. Zhou and **M. Preindl**, "Bidirectional transformerless ev charging system via reconfiguration of 4x4 drivetrain," in *IEEE Energy Conversion Congress and Exposition (ECCE)*, 2018. DOI: 10.1109/ECCE.2018.8558248

L. Zhou, F. Gao, W. Wang, and **M. Preindl**, "Transformerless three phase npc inverter with reduced switches," in *IEEE Energy Conversion Congress and Exposition (ECCE)*, 2018. DOI: 10.1109/ECCE.2018.8558033

M. Eull, M. Mohamadian, D. Luedtke, and **M. Preindl**, "A current observer to reduce the sensor count in three-phase pm synchronous machine drives," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2018. DOI: 10.1109/ITEC.2018.8450261

A. D. Callegaro, L. N. Srivatchan, D. Luedtke, and **M. Preindl**, "Optimization-based position sensorless for induction machines," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2018. DOI: 10.1109/ITEC.2018.8450137

L. Sun, **S. Nalakath**, H. B. Polli, D. Luedtke, and **M. Preindl**, "IPMSM sensorless control with accounting for risk of the voltage error and cross-coupling magnetic saturation in 48v hybrid system," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2018. DOI: 10.1109/ITEC.2018.8450204

W. Wang and **M. Preindl**, "Design and implementation of a dual cell link for battery-balancing auxiliary power modules," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2018. DOI: 10.1109/ITEC.2018.8450218

W. Wang and **M. Preindl**, "Modeling and control of a dual cell link for battery-balancing auxiliary power modules," in *IEEE Applied Power Electronics Conference and Exposition (APEC)*, 2018. DOI: 10.1109/APEC.2018.8341582

D. Wang, **M. Preindl**, F. Peng, J. Ye, and A. Emadi, "Dc-bus design with hybrid capacitor bank in single-phase pv inverters," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2017. DOI: 10.1109/IECON.2017.8216408

X. Yong and **M. Preindl**, "Homotopy continuation based observer for sensorless pmsm," in *IEEE Symposium on Predictive Control of Electrical Drives and Power Electronics (PRECEDE)*, 2017. DOI: 10.1109/PRECEDE.2017.8071280

M. Eull, **M. Preindl**, and A. Emadi, "A stochastic optimization technique for discrete dc capacitor bank design," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2017. DOI: 10.1109/ITEC.2017.7993239

M. Eull and **M. Preindl**, "Bidirectional three-level dc-dc converters: Sum-difference modeling and control," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2017. DOI: 10.1109/ITEC.2017.7993334

B. Agrawal, **M. Preindl**, and A. Emadi, "Turn-off energy minimization for soft-switching power converters with wide bandgap devices," in *IEEE International Conference on Industrial Technology (ICIT)*, 2017. DOI: 10.1109/ICIT.2017.7913089

X. Yong and **M. Preindl**, "Smallest control invariant set and error boundaries of fcs-mpc for pmsm," in *IEEE Applied Power Electronics Conference and Exposition (APEC)*, 2017. DOI: 10.1109/APEC.2017.7930848

P. Young and **M. Preindl**, "Optimal generalized overmodulation for multiphase pmsm drives," in *IEEE Applied Power Electronics Conference and Exposition (APEC)*, 2017. DOI: 10.1109/APEC.2017.7930740

B. Agrawal, **M. Preindl**, and A. Emadi, "Estimating switching losses for sic mosfets with non-flat miller plateau region," in *IEEE Applied Power Electronics Conference and Exposition (APEC)*, 2017. DOI: 10.1109/APEC.2017.7931075

S. Nalakath, **M. Preindl**, B. Nahid-Mobarakeh, and A. Emadi, "Low speed position estimation scheme for model predictive control with finite control set," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2016. DOI: 10.1109/IECON.2016.7793482

B. Agrawal, **M. Adam**, B. Vadala, H. Koke, **L. McCurlie**, **M. Preindl**, R. Ahmed, and A. Emadi, "Non-dissipative cell balancing using half-bridge switching circuit," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2016. DOI: 10.1109/ITEC.2016.7520303

Y. Miao, **M. Preindl**, P. Cheng, and A. Emadi, "Mtpa fitting and torque estimation technique based on a new flux-linkage model for interior permanent magnet synchronous machine," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2016. DOI: 10.1109/ITEC.2016.7520215

D. Schumacher, **M. Preindl**, P. Magne, B. Bilgin, and A. Emadi, "Closed loop control of a six phase inter-leaved bidirectional dc-dc boost converter for an ev/hev application," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2016. DOI: 10.1109/ITEC.2016.7520233

M. Eull, **M. Preindl**, and A. Emadi, "Analysis and design of a high efficiency, high power density silicon carbide inverter," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2016. DOI: 10.1109/ITEC.2016.7520282

Z. Nie, **M. Preindl**, and N. Schofield, "Svm strategies for multiphase voltage source inverters," in *IET Power Electronics, Machines, and Drives (PEMD) Conference*, 2016. DOI: 10.1049/cp.2016.0214

R. Rodriguez, **M. Preindl**, and A. Emadi, "Maximum power point tracking for thermoelectric generators with high frequency injection," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2015. DOI: 10.1109/IECON.2015.7392744

S. Nalakath, **M. Preindl**, Y. Yang, B. Bilgin, and A. Emadi, "Modeling and analysis of core loss of an ipm machine for online estimation purposes," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2015. DOI: 10.1109/IECON.2015.7392740

Y. Sun, **M. Preindl**, S. Sirouspour, and A. Emadi, "Nonlinear modeling and design of initial position estimation and polarity detection of ipm drives," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2015. DOI: 10.1109/IECON.2015.7392732

E. Chemali, **L. McCurlie**, B. Howey, T. Stiene, M. M. Rahman, **M. Preindl**, R. Ahmed, and A. Emadi, "Minimizing battery wear in a hybrid energy storage system using a linear quadratic regulator," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2015. DOI: 10.1109/IECON.2015.7392603

S. Nalakath, **M. Preindl**, B. Bilgin, and A. Emadi, "Modeling and analysis of ac resistance of high-speed

permanent magnet machines for online estimation purposes," in *IEEE Energy Conversion Congress and Exposition (ECCE)*, 2015. DOI: 10.1109/ECCE.2015.7309704

L. McCurlie, **M. Preindl**, P. Malysz, and A. Emadi, "Simplified control for redistributive balancing systems using bidirectional flyback converters," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2015. DOI: 10.1109/ITEC.2015.7165817

R. Gu, P. Malysz, **M. Preindl**, H. Yang, and A. Emadi, "Linear programming based design and analysis of battery pack balancing topologies," in *IEEE Transportation Electrification Conference and Expo (ITEC)*, 2015. DOI: 10.1109/ITEC.2015.7165793

M. Preindl, C. Danielson, and F. Borrelli, "Performance evaluation of battery balancing hardware," in *European Control Conference (ECC)*, 2013. [Online]. Available: http://ieeexplore.ieee.org/document/6669307/

M. Preindl, C. Danielson, and S. Bolognani, "Model predictive torque control with PWM using fast gradient method," in *IEEE Applied Power Electronic Conference and Exposition (APEC)*, 2013. DOI: 10.1109/APEC.2013.6520661

M. Preindl and S. Bolognani, "Comparison of direct and PWM model predictive control for power electronic and drive systems," in *IEEE Applied Power Electronic Conference and Exposition (APEC)*, 2013. DOI: 10.1109/APEC.2013.6520651

M. Preindl and S. Bolognani, "Optimization of the generator to rotor ratio of MW wind turbines based on the cost of energy with focus on low wind speeds," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2011. DOI: 10.1109/IECON.2011.6119431

M. Preindl and S. Bolognani, "Optimized design of two and three level full-scale voltage source converters for multi-MW wind power plants at different voltage levels," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2011. DOI: 10.1109/IECON.2011.6119899

M. Preindl and S. Bolognani, "Model predictive direct speed control of the interior permanent magnet synchronous machine with finite control set," in *IEEE Workshop on Predictive Control of Electrical Drives and Power Electronics (PRECEDE)*, 2011. DOI: 10.1109/PRECEDE.2011.6078682

M. Preindl and E. Schaltz, "Load torque compensator for model predictive direct current control in high power PMSM drive systems," in *IEEE International Symposium Industrial Electronics (ISIE)*, 2010. DOI: 10.1109/ISIE.2010.5637144

S. Waffler, **M. Preindl**, and J. Kolar, "Multi-objective optimization and comparative evaluation of Si soft-switched and SiC hard-switched automotive DC-DC converters," in *Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2009. DOI: 10.1109/IECON.2009.5415123

7 Fellowship and Grant Support

7.1 Pending Support

NYSERDA ACE Exploratory Research - $630k MPlab, $399k MPlab   submitted 03.2019
NYSERDA Advanced Clean Energy (ACE) PON 3249 - Concept paper approved
Project: *Data-Driven Monitoring and Control Enabling a Transactional Distribution Grid*
Investigator(s): Shiba Bhowmik (PI, Sinewatts Inc.), Matthias Preindl ("PI for university research"),

Khurram K. Afridi (Cornell University)

DOE EERE DE-FOA-2044 - $2M total, $1M MPlab   submitted 03.2019
FOA 2044: Natural Gas, Hydrogen, Biopower, and Electrification Technologies
Area of Interest 5: Energy Efficient Commercial Off-road Vehicles
Project: *Sensor-Driven Framework Enabling a Transactional Distribution Grid*
Investigator(s): Matthias Preindl (PI), Omer Onar (ORNL), Kent Wanner (John Deere)

Alfred P. Sloan Foundation - $1.5M, $900k MPlab   submitted 03.2019
Alfred P. Sloan Foundation, Sensor Solicitation
Project: *Sensor-Driven Framework Enabling a Transactional Distribution Grid*
Investigator(s): Matthias Preindl (PI), Ignacia Mercadal, and Xiaofan Jiang

SEAS Interdisciplinary Research Seed (SIRS) - $100k   submitted 03.2019
School of Engineering and Applied Science (SEAS), Columbia University
Project: *Data-Driven Monitoring and Control Enabling a Transactional Distribution Grid*
Investigator(s): Matthias Preindl (PI), Vijay Modi, Alan C. West, and Daniel Bienstock

7.2 Present Support

Data Science Institute Seed Fund Program - $100k   01.2019 - 12.2019
Columbia University, Data Science Institute (DSI)
Project: *"Data-driven Modeling and Estimation of Li-Ion Battery Properties"*
Investigator(s): Matthias Preindl (PI) and Alan C. West

Industry Sponsored Research - $300k   09.2018 - 08.2019
Longmax Corporation Limited
Project: *"Bidirectional Modular DC Vehicle Charger"*
Investigator(s): Matthias Preindl (PI)

Career Award - $500k   03.2017 - 02.2022
National Science Foundation (NSF)
Division of Electrical, Communications and Cyber Systems (ECCS)
Core program of Energy, Power, Control, and Networks (EPCN)
Award n. 1653574: *"Career: Virtual Modular Power (VMP) Conversion"*
Investigator(s): Matthias Preindl (PI)

Awarded discretionary fund - $45k   03.2017
Columbia University, School of Engineering and Applied Science (SEAS)
Investigator(s): Matthias Preindl (PI)

7.3 Past Support

Industry Sponsored Research - $27.9k   10.2018 - 12.2018
General Electric (GE) Global Research
Project: *"Optimization-based Position and Speed Estimation"*
Investigator(s): Matthias Preindl (PI)

Faculty Research Grant - $15k   08.2017 - 07.2018
Columbia University, School of International and Public Affairs (SIPA)
Center on Global Energy Policy (CGEP)
Project: *"Vehicle to Grid Everywhere"*
Investigator(s): Matthias Preindl (PI)

Innovation project - $65k   02.2017 - 06.2018
FIAT Chrysler Automobiles N.V. (FCA)
Project: *"Fail-safe current observer for motor drives with two current sensors"*
Investigator(s): Matthias Preindl (PI)

Laboratory donation - $21k   09.2016
Sendyne Corporation

Automotive Partnership Canada - FIAT Chrysler Automobiles   since 05.2014
Leadership in Automotive Powertrain (LEAP): Next Generation Affordable Electrified Powertrains with Superior Energy Efficiency and Performance
PI: Ali Emadi

Role: leader of the motor control research thrust area (since 07.2014)
Student co-supervision: Alan Dorneles Callegaro (since 01.2016), Ben Danen (since 01.2016), Shamsuddeen Nalakath (since 07.2014), Yingguang Sun (since 07.2014), Yu Miao (07.2014-12.2015)

Role: researcher in the power electronics research thrust area (05.2014-12.2015)
Student co-supervision: Michael Eull (05.2014-06.2015)

Canada Excellence Research Chair in Hybrid Powertrain Program   since 05.2014
PI: Ali Emadi

Role: researcher in power electronics and motor drives (05.2014-12.2015)
Student co-supervision: Ephrem Chemali (since 09.2015), Lucas McCurlie (since 05.2014)

8 Invited and Peer-Selected Presentations

M. Preindl, "Advanced control of power electronic systems for next-generation electric vehicle drivetrains," Invited Talk, Oakridge National Laboraotry (ORNL), 2019

M. Preindl, "Advanced control of power electronic systems for next-generation electric vehicle drivetrains," Invited Talk, Guoxuan High-Tech (Gotion Inc.) 2019

M. Preindl, "Advanced control of power electronic systems for next-generation electric vehicle drivetrains," Invited Talk, Technical University Graz, Institute for Electrical Drives and Machines, 2018

M. Preindl, "Optimization-based control and estimation," Keynote, IEEE International Symposium on Predictive Control of Electrical Drives and Power Electronics (PRECEDE), 2017

M. Preindl, "The future of electric vehicles and the grid," Invited Talk, Inter-American Development Bank (IADB), Information Communication Technologies (ICT) Conference, 2017

M. Preindl, "Nondissipative balancing of battery and supercapacitor modules," Invited Talk, Oxford University, Department of Engineering Science, 2015

M. Preindl, "Power electronics: A shift to systems integration," Invited Talk, Columbia University, Department of Electrical Engineering, 2015

M. Preindl, "Model predictive control in pmsm drive systems," Invited Talk, Leuphana University of Lueneburg, Institute of Product and Process, 2012

M. Preindl, "Model predictive control of power electronics and drives," Invited Talk, University of California Berkeley, Department of Mechanical Engineering, Model Predictive Control Laboratory, 2012

M. Preindl, "Switching frequency reduction using sensorless model predictive direct current control for high power vsi," Invited Talk, Aalborg University, Department of Energy Technology and KK Electronic, 2010

9 Patents and Inventions

9.1 Patents

M. Preindl and D. Bagnara, "Wind turbine for generating electric energy," WO2013001496, US9200617, 2013. [Online]. Available: `https://patents.google.com/patent/WO2013001496`

M. Casazza, F. Oberbichler, and **M. Preindl**, "Wind power turbine for generating electric energy," WO2013093855, EP2795114, US9217414, 2013. [Online]. Available: `https://patents.google.com/patent/US9217414`

9.2 Patent Applications

M. Preindl and A. Emadi, "Energy storage balancing system," US20170214252, CA2955152, 2017. [Online]. Available: `https://patents.google.com/patent/US20170214252`

M. Preindl and D. Bagnara, "Wind turbine for generating electric energy," WO2013093856, 2013. [Online]. Available: `https://patents.google.com/patent/WO2013093856`

A. Fasolo, **M. Preindl**, M. Scuotto, and T. Kaessner, "Wind power turbine and wind power turbine control method," WO2013093894, 2013. [Online]. Available: `https://patents.google.com/patent/WO2013093894`

10 Service

10.1 Professional Service

10.1.1 Peer Reviewer

Publications (recurrent)
IEEE Transactions on Power Electronics
IEEE Transactions on Industrial Electronics
International IEEE conferences, mainly APEC, ECCE, IECON, ITEC

10.1.2 International Conferences

IEEE Transportation Electrification Conference & Expo (ITEC)
General chair, 2022 (approved by IEEE)
Program chair, 2021 (approved by IEEE)
Co-program chair, 2020 (approved by IEEE)
Treasurer, 2019
Assistant program chair and publication chair, 2018
Technical program co-chair, 2017
Session chair, 2014 - 2018

IEEE Symposium on Predictive Control of El. Drives and Power Electronics (PRECEDE)
Steering committee, 2017, 2019

IEEE International Symposium on Sensorless Control for Electrical Drives (SLED)
Technical program committee, 2018

IEEE Energy Conversion Congress and Exposition (ECCE)
Topic chair, 2016, 2017

Columbia 2017 Forum - Electrified Transportation: Challenges and Future Trends
Chair, 2017

10.2 Academic Service

10.2.1 Committees, Department of Electrical Engineering, Columbia University

Undergraduate Affairs
UG Affairs/Recruiting (2017/18, 2018/19)

Graduate Affairs
MS Program: MS Career/Development/Internships (2016/17, 2017/18, 2018/19)
MS Program: MS Advising/Monitoring/Awards (2016/17, 2017/18, 2018/19)
PhD Program: PhD Admissions (2016/17)

Special Comittees
EE Distinguished Lectures (2018/19)

Services
Minutes/Records (2016/17, 2017/18, 2018/19)

10.2.2 PhD Committees

PhD Thesis Defense Committee
Doyun Kim, 10.2018, Electrical Engineering, Supervisor: Mingoo Seok
Kevin Tien, 09.2018, Electrical Engineering, Supervisor: Kenneth Shepard
Sharvil Patil, 11.2016, Electrical Engineering, Supervisor: Yannis Tsividis
Thomas Nikolakakis, 09.2016, Earth & Environmental Engineering, Supervisor: Vasilis Fthenakis

PhD Thesis Proposal Exam Committee
John Barth, 12.2018, Electrical Engineering, Supervisor: Kenneth Shepard
Doyun Kim, 04.2018, Electrical Engineering, Supervisor: Mingoo Seok

10.2.3 Relevant Invited Talks at Columbia University

M. Preindl, "Electrified transportation: Challenges and future trends," Columbia University, Board of Visitors, Fall Board Meeting, 2017

M. Preindl, "Electrified transportation," Columbia University, Engineering for Humanity - Smart Cities: Sustainable, Healthy, Secure, Connective, Creative, 2017

M. Preindl, "Generation, sensing/control, power electronics, building/vehicle integration," Columbia University, Engineering for Humanity - Repowering the Planet, 2017

10.2.4 Organization of Talks and Seminars

G. Bramerdorfer, "Aspects of modern optimization of rotating electric machines," Invited Talk at Columbia University, 2018, Speaker affiliation: Johannes Kepler University Linz

A. Darvishi, "Threshold-based monitoring of cascading outages with pmus," Invited Talk at Columbia University, 2017, Speaker affiliation: New York Power Authority (NYPA)

B. Nahid-Mobarakeh, "Stability analysis of standalone microgrids: Application to electrified transportation systems," Invited Talk at Columbia University, 2017, Speaker affiliation: Université de Lorraine

D. Gu, "Power conversion for hydrogen fuel cell hybrid electric vehicles propulsion," Invited Talk at Columbia University, 2017, Speaker affiliation: Unique Technical Services (UTS)

A. Mohamed, "Recuperation of regenerative braking energy in electric rail systems," Invited Talk at Columbia University, 2017, Speaker affiliation: City College of New York

P. Zanchetta, "Application of repetitive control to power electronics systems," Invited Talk at Columbia University, 2017, Speaker affiliation: University of Nottingham

M. O'Grady, "Sic enabling ev power conversion," Invited Talk at Columbia University, 2017, Speaker affiliation: United Silicon Carbide

D. Da Rù and M. De Soricellis, "Model-based control," Invited Talk at Columbia University, 2017, Speaker affiliation: University of Padua

P. P. Malysz, "Advanced battery modeling and estimation for electrified transportation," Invited Talk at Columbia University, 2017, Speaker affiliation: FIAT Chrysler Automobile (FCA)

N. Clauvelin, "Battery modeling for system design," Invited Talk at Columbia University, 2017, Speaker affiliation: Sendyne

L. Gauchia, "Multi-life opportunities of ev batteries for grid applications," Invited Talk at Columbia University, 2017, Speaker affiliation: Michigan Technological University

A. Reid, "The future of ev and electric grid," Invited Talk at Columbia University, 2017, Speaker affiliation: Consolidated Edison

M. Payne, "Challenges and solutions for next generation vehicel batteries," Invited Talk at Columbia University, 2017, Speaker affiliation: Gotion

D. Sciano and A. Reid, "The evolution of electric power systems," Invited Talk at Columbia University, 2017, Speaker affiliation: Consolidated Edison

A. Khaligh, "Maryland power electronics laboratory," Invited Talk at Columbia University, 2016, Speaker affiliation: University of Maryland

B. Arnet, "PLECS: Advanced modeling and simulation of power electronic systems," Seminar at Columbia University, 2016, Speaker affiliation: Plexim

M. H. Nazari, "Distributed control of prosumer-based smart grids," Invited Talk at Columbia University, 2016, Speaker affiliation: California State University, Long Beach

11 Languages

German   native

English   fluent
C1, TOEFL Certificate, 2008

Italian   fluent
Exam of bilingualism (German and Italian), highest level (A - referred to the doctoral degree)
Province Bolzano/Bozen Certificate, 2006

12 References

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