

Ayman EL-Refaie, Ph.D.,
Professor of Electrical Engineering
Thomas and Suzanne M. Werner Endowed Chair
Marquette University
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Education:

University of Wisconsin-Madison
Ph.D. Electrical and Computer Engineering, 2005

University of Wisconsin-Madison
M.S. Electrical Engineering, 2002

Cairo University
M.S. Electrical Power and Machines, 1998

Cairo University
B.S. Electrical Power and Machines, 1995

Professional Experience:

- (1) Marquette University, Milwaukee, WI, January 2017-Present
 - Professor of Electrical Engineering, Thomas and Suzanne M. Werner Endowed Chair
 - Focus on energy sustainability, hybrid/electrical traction applications and aerospace applications.

- (2) General Electric Global Research Center, Niskayuna, NY, November 2005-December 2016
 - Principal Engineer and project leader
 - Principal Investigator and program manager of a 6 Million USD project with Department of Energy to develop advanced traction motors for hybrid applications.
 - Principal Investigator and program manager of a 12 Million USD project with the Department of Energy to develop advanced non-rare earth traction motors for hybrid applications.
 - Project leader for several internal GE projects
 - Working on various energy conversion projects (with focus on electrical machines designs and electrical drives) for various applications including:
 - Mining
 - Aerospace applications

- Hybrid vehicles
- Renewable energy sources
- Water desalination
- Instructor of the “A Course”, which is part of the prestigious Edison Engineering Development Program

(2) General Motors Advanced Technology Center (GM-ATC) Torrance, CA, Summer 2002

- Development engineer. Providing support and writing a manual for IPM machines design optimization software. Participated in designing a belt starter/alternator. Torque ripple minimization in IPM machines.

(3) University of Wisconsin Madison, Dept. of Electrical & Computer Engineering
Research Assistant/Post Doctor, August 1999-2005

- Designing and testing surface PM machines using concentrated windings to achieve optimal flux weakening (Sponsored by the DOE and Oak Ridge National Lab)
- Participated in the design of a 50 KW IPM prototype for traction applications
- Designing interior permanent magnet motor for the MIT Automotive Consortium to be used as a starter/alternator (both direct-drive and offset-coupled) using a new bi-state magnetic material by HITACHI to extend the high-speed operation envelope.
- Designing an IPM motor for GM-ATC to be used as a traction motor in hybrid vehicles.
- Thermal modeling of IPM machines.
- Mechanical stress analysis of IPM machines
- Testing of magnetic materials (mechanical and magnetic properties)
- Fast thermal profiling of semiconductor devices

(4) University of Wisconsin Madison, Dept. of Electrical & Computer Engineering
Teaching Assistant, Spring/Fall 2003

- ECE 355. Duties include discussion sessions, grading assignments and exams

(5) Consultant

August 1995-August 1999

- Participated in many projects involving the design of distribution systems for factories and hospitals.
- Testing of elevators motors in many projects.

(6) Cairo University

Assistant Lecturer, August 1995-August 1999

- Taught courses in electrical circuits, electrical machines, protection systems, high voltage engineering, power electronics and design of distribution systems for freshman up to senior and graduate level.
- Lecturing, composing exams and grading.

(7) American University Cairo (AUC)

Assistant Lecturer, August 1996-August 1998

- Part time assistant lecturer for electrical circuits and electrical machines courses.

(8) IEEE

- *Elevated to Fellow, 2013*

- IEEE Industry Applications Society (IAS) Industrial Power Conversion Systems Department Vice Chair 2016-2017
- IEEE Industry Applications Society Executive Board Member-At-Large 2016-2017
- IEEE Transportation Electrification Community (TEC) Steering Committee
Member/IAS representative 2014-2015

IEEE Industry Applications Society, Awards Comm.

Member “Outstanding Young Member Award” committee from 2010 to Present

- IEEE Industry Applications Society, Electric Machines Comm.
Member/Reviewer 2002 to Present
Associate Editor 2012 to present
Paper Awards Selection Comm. Member 2012
- IEEE Industry Applications Society, Transportation Systems Comm.
Founding Member 2011
Vice Chair, Paper Reviews 2011 to 2013
Chair 2014-2015
- IEEE Energy Conversion Congress and Exposition (ECCE)
Steering Committee Chair 2015
General Chair ECCE '14
Technical Program Co-Chair ECCE '11
Technical Program Vice-Chair ECCE '10, 12, 13
Technical Program Topic-Chair ECCE '09
Session Chair ECCE-Asia '11
Session Chair ECCE '09-16
- IEEE industry Applications Society Annual Meeting (IAS Annual Meeting)
Session Chair/Organizer IAS '06-08
Reviewer IAS '02-08
- IEEE International Electrical Machines and Drives Conference (IEMDC)
Session Chair/Organizer IEMDC '09, 11
Reviewer IEMDC '03-11
Organizing committee member IEMDC '03
- IEEE International Conference on Electrical Machines (ICEM)
Technical program Track Co-Chair ICEM '12

Reviewer

ICEM '04-12

- IEEE International Conference on Electrical Machines and Systems (ICEMS)
Technical program committee member ICEMS '10, ICEMS '14
- IEEE Power and Energy Society
Member/Reviewer Transactions on Energy Conversion 2001 to present
Member Motor Subcommittee WGP1812 Guide for Testing Permanent Magnet Machines 2011
- IEEE Industrial Electronics Society
Member/Reviewer Transactions on Industrial Electronics 2007 to present
Awards selection comm. member for the Electrical Machines Committee 2009
Invited speaker at the IEEE 1st Workshop on Electrical Machines Design, Control and Diagnostics (WEMDCD), March 11-12, 2013, Paris, France
- IEEE Power Electronics Society
Reviewer Transactions on Power Electronics 2007 to present
- IEEE Magnetics Society
Reviewer INTERMAG/Transactions on Magnetics 2005 to present
- IEEE Aerospace and Electronics Society
Reviewer Transactions on Aerospace and Electronics 2005 to present
- Reviewer of several other journals and conferences

(9) SAE: Society of Automotive Engineers

Member of Hybrid E-Motor Rating Task Force (Starting August 2008)

Publications:

Journal Papers:

(1) Patel Reddy, **Ayman El-Refaie** and James Alexander, "Design of Synchronous Reluctance Motor Utilizing Dual-Phase Magnetic Materials for Traction Applications", accepted for publication in the IEEE Transactions on Industry Applications.

(2) Tsarafidy Raminosoa, David Torrey, **Ayman El-Refaie**, Kevin Grace, Di Pan, Stefan Grubic, Karthik Bodla and Kum-Kang Huh, "Sinusoidal Reluctance Machine with DC Winding: an Attractive Non-Permanent Magnet Option", in *IEEE Transactions on Industry Applications*, vol. 52, no. 3, pp. 2129-2137, May-June 2016.

(3) Patel Reddy, Kevin Grace, and **Ayman EL-Refaie**, "Conceptual Design of Sleeve Rotor Synchronous Reluctance Motor for Traction Applications", in *IET Electric Power Applications*, vol. 10, no. 5, pp. 368-374, 5 2016, special issue on synchronous reluctance machines

- (4) James McFarland, Thomas Jahns, **Ayman EL-Refaie**, “Analysis of the Torque Production Mechanism for Flux-Switching Permanent Magnet Machines” in *IEEE Transactions on Industry Applications*, vol. 51, no. 4, pp. 3041-3049, July-Aug. 2015.
- (5) Tsarafidy Raminosoa, **Ayman EL-Refaie**, Di Pan, Kum Kang Huh, James Alexander, Kevin Grace, Steven Galioto, Patel Reddy and Xiaochun Shen, “Reduced Rare-Earth Flux Switching Machines for Traction Applications” in *IEEE Transactions on Industry Applications*, vol. 51, no. 4, pp. 2959-2971, July-Aug. 2015.
- (6) Steven Alioto, Patel Reddy, **A.M.EL-Refaie**, James P. Alexander, "Effect of Magnet Types on Performance of High Speed Spoke Interior Permanent Magnet Machines designed for Traction Applications", in *IEEE Transactions on Industry Applications*, vol. 51, no. 3, pp. 2148-2160, May-June 2015.
- (7) **A.M.EL-Refaie**, James P. Alexander, Steven Alioto, Patel Reddy, Kum-Kang Huh, Peter DeBock, and Xiaochun Shen “Advanced High Power Density Interior Permanent Magnet Motor for Traction Applications”, in *IEEE Transactions on Industry Applications*, vol. 50, no. 5, pp. 3235-3248, Sept.-Oct. 2014.
- (8) Patel Reddy, **A.M.EL-Refaie**, Kum-Kang Huh, “Effect of Number of Layers on Performance of Fractional-Slot Concentrated-Windings Interior Permanent Magnet Machines”, in *IEEE Transactions on Power Electronics*, vol. 30, no. 4, pp. 2205-2218, April 2015.
- (9) Boglietti, Aldo, **El-Refaie, Ayman**, Drubel, Oliver, Omekanda, Avoki, Bianchi, Nicola, Agamloh, Emmanuel, Popescu, Mircea, Di Gerlando, Antonino, Borg Bartolo, James, “Electrical Machine Topologies: Hottest Topics in the Electrical Machine Research Community”, in *IEEE Industrial Electronics Magazine*, vol. 8, no. 2, pp. 18-30, June 2014
- (10) **Ayman EL-Refaie**, Manoj Shah, Kum-Kang Huh, “High Power-Density Fault-Tolerant Permanent Generator for Safety Critical Applications”, *IEEE Transactions on Industry Applications*, vol.50, no.3, pp.1717-1728, May-June 2014
- (11) Patel Reddy, Kum-Kang Huh, **A.M.EL-Refaie**, “Generalized Approach of Stator Shifting in Interior PM Machines Equipped with Fractional-Slot Concentrated Windings”, *IEEE Transactions on Industrial Electronics*, vol.61, no.9, pp.5035-5046, Sept. 2014
- (12) **A.M. El-Refaie**, “Motors/Generators for Traction/Propulsion Applications”, *IEEE Vehicular Technology Magazine*, vol.8, no.1, pp.90-99, March 2013.
- (13) P.B. Reddy, **A.M. EL-Refaie**, Kum-Kang Huh, J.K. Tangudu, and T.M. Jahns, “Comparison of Interior and Surface PM Machines Equipped with Fractional-Slot Concentrated Windings for Hybrid Traction Applications” *IEEE Transactions on Energy Conversion*, vol.27, no.3, pp.593-602, Sept. 2012.
- (14) **A.M. El-Refaie**, and M.R.Shah, “Induction Machines Performance with Fractional-Slot Concentrated Windings”, *COMPEL*, Volume 31, issue 1
- (15) **A.M. El-Refaie**, Manoj Shah, J.P. Alexander, S. Galitoto, Kum-Kang Huh, W.D. Gerstler, “Rotor End Losses in Multi-Phase Fractional-Slot Concentrated-Winding Permanent Magnet Synchronous Machines”, *IEEE Transactions on Industry Applications*, vol.47, no.5, pp.2066-2074, Sept.-Oct. 2011
- (16) Manoj Shah, **A.M. El-Refaie**, “End Effects in Multi-Phase Fractional-Slot Concentrated-Winding Surface Permanent Magnet Synchronous Machines”, *IEEE Transactions on Energy Conversion. Volume: 25, Issue: 4, Dec. 2010, Pages 1001-1009*

- (17) **A.M. EL-Refaie**, “Fault-Tolerant PM Machines: A Review”, *Electric Power Applications, IET*, vol.5, no.1, pp.59-74, January 2011
- (18) **A.M. EL-Refaie**, “Fractional-Slot Concentrated-Windings Synchronous Permanent Magnet Machines: Opportunities and Challenges”, *IEEE Transactions on Industrial Electronics, Volume: 57, Issue: 1, Jan. 2010, Pages 107-121*.
- (19) M.R.Shah, and **A.M. EL-Refaie**, “Eddy Current Loss Minimization in Conducting Sleeves of High Speed Machine Rotors by Optimal Axial Segmentation and Copper Cladding”, *IEEE Transactions on Industry Applications. Volume: 45, Issue: 2, March-April 2009, Pages 720-728*.
- (20) **A.M. EL-Refaie**, T.M. Jahns, and J. McKeever. “Modified Vector Control Algorithm for Increasing Partial-Load Efficiency of Fractional-Slot Concentrated Winding Surface PM Machines”, *IEEE Transactions on Industry Applications. Volume: 44, Issue: 5, Sept.-Oct. 2008, Pages 1543-1551*.
- (21) **A.M. EL-Refaie**, and T.M. Jahns, “Impact of Winding Layer Number and Magnet Type on Synchronous Surface PM Machines Designed for Wide Constant-Power Speed Range Operation”, *IEEE Transactions on Energy Conversion. Volume: 23, Issue: 1, March 2008, Pages 53-60*.
- (22) **A.M. EL-Refaie**, M.R.Shah, R. Qu, and J. Kern, “Effect of Number of Phases on Conducting Sleeve Losses of High-Speed Surface PM Machine Rotors”, *IEEE Transactions on Industry Applications. Volume: 44, Issue: 5, Sept.-Oct. 2008, Pages 1552-1532*.
- (23) **A.M. EL-Refaie**, T.M. Jahns, and J.W. McKeever, “Effect of Back-EMF Constraints on Fractional-Slot Surface PM Machines Designed for Wide Constant-Power Speed Range Operation”, *Electric Power Components & Systems, Volume 36, Number 2, February 2008*
- (24) **A.M. EL-Refaie**, and T.M. Jahns. “Comparison of Synchronous PM Machine Types for Wide Constant-Power Speed Operation: Converter Performance”, *IET Electric Power Applications, Volume1, issue 2, Pages: 217-222*
- (25) **A.M. EL-Refaie**, and T.M. Jahns, “Scalability of Surface PM Machines with Concentrated Windings Designed to Achieve Wide Speed Ranges of Constant-Power Operation” *IEEE Transactions on Energy Conversion, Volume: 21, Issue: 2, June 2006, Pages: 362 – 369*.
- (26) J.J. Nelson, G. Venjataramanan, and **A.M. EL-Refaie**, “Fast Thermal Profiling of Power Semiconductor Devices using Fourier Techniques” *IEEE Transactions on Industrial Electronics, Volume: 53, Issue: 2, April 2006, Pages: 521 – 529*.
- (27) **A.M. EL-Refaie**, T.M. Jahns, and D.W. Novotny, “Analysis of Surface PM Machines Equipped with Concentrated Windings” *IEEE Transactions on Energy Conversion, Volume: 21, Issue: 1, March 2006, Pages: 34 – 43*.
- (28) **A.M. EL-Refaie**, T.M. Jahns, Patrick J. McCleer, and John W. McKeever “Experimental Verification of Optimal Flux Weakening in Surface PM Machines Using Concentrated Windings” *IEEE Transactions on Industry Applications, Volume: 42, Issue: 2, March-April 2006, Pages: 443 – 453*.
- (29) **A.M. EL-Refaie**, and T.M. Jahns, “Optimal flux Weakening in Surface PM Machines Using Concentrated Windings”, *IEEE Transactions on Industry Applications, Volume: 41, Issue: 3, May-June, 2005, Pages: 790 – 800*.

- (30) **A.M. EL-Refaie**, and T.M. Jahns, “ Application of Bi-State Magnetic Material to an Automotive IPM Starter/Alternator Machine ”, *IEEE Transactions on Energy Conversion*, Volume: 20, Issue: 1, March 2005, Pages: 71 – 79.
- (31) **A.M. EL-Refaie**, D.W. Novotny, and T.M. Jahns, “A Simple Model for Flux Weakening in Surface PM Synchronous Machines Using Back-to-Back Thyristors”, *IEEE Power Electronics Letters*, Volume: 2, Issue: 2, June 2004, Pages: 54 – 57.
- (32) **A.M. EL-Refaie**, R. Manzke, and T.M. Jahns, " Application of Bi-State Magnetic Material to Automotive Offset-Coupled IPM Starter/Alternator Machine", *IEEE Transactions on Industry Applications*, Volume: 40, Issue: 3, May-June 2004, Pages: 717 – 725.
- (33) **A.M. EL-Refaie**, N.C. Harris, T.M. Jahns, and K.M. Rahman, “ Thermal Analysis of Two-Barrier Interior Permanent Magnet Machine Using Lumped Parameter Model” *IEEE Transactions on Energy Conversion*, Volume: 19, Issue: 2, June 2004, Pages: 303 – 309.
- (34) **A.M. EL-Refaie** et al., “Effect of Combined Velocity and Pressure on Life Time of Carbon Brushes”, *IEEE Transactions on Energy Conversion*. Volume: 15, Issue: 2, June 2000, Pages 176-180.
- (35) **A.M. EL-Refaie**, and T.M. Jahns, " Comparison of Synchronous PM Machine Types for Wide Constant-Power Speed Range Operation”, *COMPEL*, Volume 27, issue 5, Pages 967-984, 2008
- (36) **A.M. EL-Refaie**, Z.Q. Zhu, T.M. Jahns, and D. Howe, “Winding Inductances in Fractional Slot Surface-Mounted Permanent Magnet Brushless Machines”, *COMPEL*, Volume 28, issue 6, Pages 1590-1606, 2009

Conference Papers:

- (1) Reddy, Patel; Zou, Min; Pan, Di; Alexander, James; Tapadia, Nidhishri; Grace, Kevin; Huh, Kumkang; **EL-Refaie, Ayman**; Johnson, Frank, “Performance Testing and Analysis of Synchronous Reluctance Motor Utilizing Dual-Phase Magnetic Material”, to be presented at IEMDC 2017, Miami, FL.
- (2) James P. Alexander, Steven Galioto, and **Ayman EL-Refaie**, “First Order Mechanical Sizing Equations for the Electromagnetic Optimization of Spoke IPM Machines” to be presented at ICEM 2016, Lausanne, Switzerland.
- (3) **Ayman EL-Refaie**, “Growing Role of Electrical Machines and Drives in Electrification” to be presented at ICEM 2016, Lausanne, Switzerland.
- (4) **Ayman EL-Refaie**, Tsarafidy Raminosoa, Patel Reddy, Steven Galioto, Di Pan, Kevin Grace, James Alexander and Kum-Kang Huh, “Comparison of Traction Motors that Reduce or Eliminate Rare-Earth Materials”, presented at ECCE 2016, Milwaukee, WI
- (5) Tsarafidy Raminosoa, **Ayman EL-Refaie**, David Torrey, Kevin Grace, Di Pan, Stefan Grubic, Karthik Bodla and Kum-Kang Huh, “Test Results for a High Temperature Non-Permanent Magnet Traction Motor”, presented at ECCE 2016, Milwaukee, WI.
- (6) Patel Reddy, **Ayman EL-Refaie** and James Alexander, “Design of Synchronous Reluctance Motor Utilizing Dual-Phase Magnetic Materials for Traction Applications”, presented at ECCE 2015, Montreal, Canada

- (7) James McFarland, Thomas Jahns and **Ayman EL-Refaie**, “Performance and Efficiency Comparisons for Interior PM and Flux-Switching PM Machines with Ferrite Magnets for Automotive Traction Applications”, presented at ECCE 2015, Montreal, Canada
- (8) Tsarafidy Raminosoa, David Torrey, **Ayman EL-Refaie**, Kevin Grace, Di Pan, Stefan Grubic, Karthik Bodla and Kum-Kang Huh, “Sinusoidal Reluctance Machine with DC Winding: an Attractive Non-Permanent Magnet Option”, presented at ECCE 2015, Montreal, Canada
- (9) **Ayman EL-Refaie**, “Integrated Electrical Machines and Drives: An Overview”, presented at IEMDC 2015, Coeur d’Alene, Idaho
- (10) Patel Reddy, Kevin Grace, and **Ayman EL-Refaie**, “Conceptual Design of Sleeve Rotor Synchronous Reluctance Motor for Traction Applications”, presented at IEMDC 2015, Coeur d’Alene, Idaho
- (11) Tsarafidy Raminosoa, David Torrey, **Ayman EL-Refaie**, Di Pan, Stegan Grubic, and Kevin Grace, “Robust Non-Permanent Magnet Motors for Vehicle Propulsion”, presented at IEMDC 2015, Coeur d’Alene, Idaho
- (12) James McFarland, Thomas Jahns, **Ayman EL-Refaie** , “Demagnetization Performance Characteristics of Flux Switching Permanent Magnet Machines”, ICEM 2014, September 2014, Berlin
- (13) Tsarafidy Raminosoa, **Ayman EL-Refaie**, Di Pan, Kum Kang Huh, James Alexander, Kevin Grace, Steven Galioto, Patel Reddy and Xiaochun Shen, “Reduced Rare-Earth Flux Switching Machines for Traction Applications” ECCE 2014, September 14-18, Pittsburgh, PA
- (14) James McFarland, Thomas Jahns, **Ayman EL-Refaie**, “Analysis of the Torque Production Mechanism for Flux-Switching Permanent Magnet Machines” ECCE 2014, September 14-18, Pittsburgh, PA
- (15) Patel Reddy, Steve Galioto and **Ayman EL-Refaie**, “Effect of Magnet Types on Performance of High Speed Spoke Interior Permanent Magnet Machines designed for Traction Applications” ECCE 2014, September 14-18, Pittsburgh, PA
- (16) James McFarland, Thomas Jahns, **Ayman EL-Refaie** and Patel Reddy, ”Effect of Magnet Properties on Power Density and Flux-Weakening Performance of High-Speed Interior Permanent Magnet Synchronous Machines” ECCE 2014, September 14-18, Pittsburgh, PA
- (17) **Ayman EL-Refaie**, James Alexander, Kum-Kang Huh, Steven Galioto, Patel Reddy, Xiaochun Shen and Peter De Bock , “Advanced High Power-Density Interior Permanent Magnet Motor for Traction Applications”, presented at IEEE ECCE 2013
- (18) **Ayman EL-Refaie**, Manoj Shah, Kum-Kang Huh, “High Power-Density Fault-Tolerant Permanent Generator for Safety Critical Applications”, presented at IEEE IEMDC 2013
- (19) **Ayman EL-Refaie**, “Fractional-Slot Concentrated-Windings: A Paradigm Shift in Electrical Machines”, presented at IEEE WEMDCD 2013
- (20) **Ayman EL-Refaie**, Rebecca Nold, Kiruba Haran, Manoj Shah, Konrad Weeber, Kum-Kang Huh, James Alexander, Charles Stephens, Steven Galioto, “Testing of Advanced Permanent Magnet Machines for a Wide Range of Applications”, presented at ICEM 2012

- (21) Patel Reddy, **Ayman EL-Refaie** and Kum-Kang Huh, “Effect of Stator Shifting on Harmonic Cancellation and Flux Weakening Performance of Interior PM Machines Equipped with Fractional-Slot Concentrated-Windings for Hybrid Traction Applications”, presented at ECCE 2012
- (22) William Gerstler, Kum-Kang Huh, Eric Ruggiero, Farshad Ghasripoor, **Ayman EL-Refaie**, Peter de Bock, Xiaochun Shen, and James Alexander, “Experimental Results of a Non-Metallic Brush Seal for High-Power Density, Liquid-Cooled, Rotating Electric Machines”, 48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit, 31 Jul - 1 Aug 2012, Atlanta, GA
- (23) William D. Gerstler, Eric J. Ruggiero, Farshad Ghasripoor, **Ayman EL-Refaie**, H. Peter De Bock, Xiaochun Shen and James P. Alexander, “ A Liquid-Cooled Rotor for High Density Electric Machines”, 47th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit, 31 Jul - 3 Aug 2011, San Diego, CA
- (24) Patel Reddy, **A.M. EL-Refaie** , kum-Kang Huh, Jagadeesh Tangudu, and Thomas Jahns “Comparison of Interior and Surface PM Machines Equipped with Fractional-Slot Concentrated-Windings for Hybrid Traction Applications”, 2011 IEEE Energy Conversion Congress and Exposition ECCE 2011, September 17-22, Phoenix, AZ, USA
- (25) **A.M. EL-Refaie**, “Electrical Linear Commercial Drives: A Review”, The Eighth International Symposium on Linear Drives for Industry Applications (LDIA 2011), July. 3-6, Eindhoven, Netherlands
- (26) Patel Reddy, **A.M. EL-Refaie**, kum-Kang Huh, “Effect of Number of Layers on Performance of Fractional-Slot Concentrated-Windings Interior Permanent Magnet Machines”, 2011 IEEE 8th International Conference on Power Electronics ECCE Asia ,May 30-June 3, 2011, Jeju, Korea
- (27) **A.M. EL-Refaie**, “Motors/Generators for Traction/Propulsion Applications”, 2011 International Electrical Machines and Drives Conference IEMDC 2011, May. 15-18, Niagara Falls, ON, Canada
- (28) Francis Johnson, Satish Prabhakaran, **Ayman EL-Refaie**, “The requirements of soft magnetic materials for industrial applications”, 2011 TMS Annual Meeting & Exhibition, Magnetic Materials for Energy Applications Symposium, February 27 - March 3, 2011 • San Diego
- (29) **Ayman M. EL-Refaie**, James P. Alexander, Steven. Galitoto, Manoj R. Shah, Kum-Kang Huh, William D. Gerstler, Jagadeesh Tangudu, and Thomas M. Jahns, “Scalable, Low-Cost, High Performance IPM Motor for Hybrid Vehicles”, 2010 International Conference of Electrical Machines ICEM 2010, Sept.. 6-9, Rome, Italy
- (30) **A.M. EL-Refaie**, Manoj Shah, J.P. Alexander, S. Galitoto, Kum-Kang Huh, W.D. Gerstler, “Rotor End Losses in Multi-Phase Fractional-Slot Concentrated-Winding Permanent Magnet Synchronous Machines”, 2010 Energy Conversion Congress and Exposition ECCE 2010, Sept. 12-16, Atlanta, GA
- (31) Jagadeesh Tangudu, Thomas M. Jahns, **A.M. EL-Refaie**, “Core Loss Prediction Using Magnetic Circuit Model for Fractional-Slot Concentrated-Winding Interior Permanent Magnet Machines”, 2010 Energy Conversion Congress and Exposition ECCE 2010, Sept. 12-16, Atlanta, GA
- (32) Jagadeesh Tangudu, Thomas M. Jahns, **A.M. EL-Refaie**, “Unsaturated and Saturated Saliency Trends in Fractional-Slot Concentrated-Winding Interior

- Permanent Magnet Machines”, 2010 Energy Conversion Congress and Exposition ECCE 2010, Sept. 12-16, Atlanta, GA
- (33) Konrad Weeber, Manoj Shah, Kiruba Haran, Ayman EL-Refaie, Ronghai Qu, Chales Stephens, and Steven Galioto, “Advanced Permanent Magnet Machines for a Wide Range of Industrial Applications”, 2010 IEEE PES General Meeting, July 26-29, Minneapolis, USA.
- (34) Manoj Shah, A.M. El-Refaie, “End Effects in Multi-Phase Fractional-Slot Concentrated-Winding Surface Permanent Magnet Synchronous Machines”, 2009 Energy Conversion Congress and Exposition ECCE 2009, Sept. 20-24, San Jose, CA
- (35) Jagadeesh Tangudu, Thomas M. Jahns, A.M. El-Refaie, Z.Q. Zhu, “Segregation of Torque Components in Fractional-Slot Concentrated-Winding Interior Permanent Magnet Machines Using Frozen Permeability”, 2009 Energy Conversion Congress and Exposition ECCE 2009, Sept. 20-24, San Jose, CA
- (36) Jagadeesh Tangudu, Thomas M. Jahns, A.M. El-Refaie, Z.Q. Zhu, “Lumped Parameter Magnetic Circuit Model for Fractional-Slot Concentrated-Winding Interior Permanent Magnet Machines”, 2009 Energy Conversion Congress and Exposition ECCE 2009, Sept.. 20-24, San Jose, CA
- (37) Manoj Shah, A.M. El-Refaie, Kiruba Sivasubramaniam “Analysis of Turn-to-Turn Faults in Surface PM Machines with Multi-Layer Fractional-Slot Concentrated Windings”, 2008 International Conference of Electrical Machines ICEM 2008, Sept.. 6-9, Vilamoura, Portugal
- (38) A.M. El-Refaie, “Fault-Tolerant PM Machines: A Review”, 2009 International Electrical Machines and Drives Conference IEMDC 2009, May. 3-6, Miani, FL
- (39) Manoj Shah, A.M. El-Refaie, Kiruba Sivasubramaniam “Analysis of Turn-to-Turn Faults in Surface PM Machines with Multi-Layer Fractional-Slot Concentrated Windings”, to appear in 2008 International Conference of Electrical Machines ICEM 2008, Sept.. 6-9, Vilamoura, Portugal
- (40) A.M. El-Refaie, and M.R.Shah, “Comparison of Induction Machines with Distributed and Fractional-Slot Concentrated Windings”, to appear in 2008 IAS Annual Meeting, Oct. 2-5, Edmonton, Alberta
- (41) A.M. El-Refaie, Z.Q. Zhu, T.M. Jahns, and D. Howe, “Investigation of Winding Inductances in Fractional Slot Surface-Mounted Permanent Magnet Brushless Machines”, to appear in 2008 IAS Annual Meeting, Oct. 2-5, Edmonton, Alberta
- (42) P. Reddy, and A.M. El-Refaie, “Impact of Winding Layer Number and Slot/Pole Combination on AC Armature Losses of Synchronous Surface PM Machines Designed for Wide Constant-Power Speed Range Operation”, to appear in 2008 IAS Annual Meeting, Oct. 2-5, Edmonton, Alberta
- (43) A.M. EL-Refaie,“ Fractional-Slot Concentrated-Windings Synchronous PM Machines: A Survey” *EVER 2008, March 2008, Monaco. (Keynote presentation)*
- (44) M.R.Shah, and A.M. El-Refaie, “Eddy Current Loss Minimization in Conducting Sleeves of High Speed Machine Rotors by Optimal Axial Segmentation and Copper Cladding”, *2007 IAS Annual Conference, 2007, New Orleans.*
- (45) A.M. El-Refaie, M.R.Shah, R. Qu, and J. Kern, “Effect of Number of Phases on Conducting Sleeve Losses of High-Speed Surface PM Machine Rotors”, *2007 IAS Annual Conference, 2007, New Orleans.*

- (46) W.L. Soong , P. Reddi, **A.M. EL-Refaie**, T.M. Jahns, and N. Ertugrul “Use of Parameter Plane in Designing Surface PM Machines for Wide Field-Weakening Range Applications”, *2007 IAS Annual Conference, 2007, New Orleans*.
- (47) T.M. Jahns, S.H Han, **A.M. EL-Refaie**, J.H. Baek, M. Aydin, M.K. Guven, and W. Soong. “Design and Experimental Verification of a 50 kW Interior Permanent Magnet Synchronous Machine”, *2006 IAS Annual Conference. Oct 8-12, 2006, Tampa, FL*.
- (48) **A.M. EL-Refaie**, T.M. Jahns, and J. McKeever. “Modified Vector Control Algorithm for Increasing Partial-Load Efficiency of Fractional-Slot Concentrated Winding Surface PM Machines”, *2006 IAS Annual Conference. Oct 8-12, 2006, Tampa, FL. Submitted to IEEE Transactions on Industry Applications*.
- (49) **A.M. EL-Refaie**, and T.M. Jahns, “Impact of Winding Layer Number and Magnet Type on Synchronous Surface PM Machines Designed for Wide Constant-Power Speed Range Operation”, *2006 IAS Annual Conference. Oct 8-12, 2006, Tampa, FL*.
- (50) **A.M. EL-Refaie**, T.M. Jahns, and J.W. McKeever, “Effect of Back-EMF Constraints on Fractional-Slot Surface PM Machines Designed for Wide Constant-Power Speed Range Operation”, *2006 International Conference on Electrical Machines (ICEM'06), Sept. 2-5, 2006, Chania, Greece*.
- (51) **A.M. EL-Refaie**, and T.M. Jahns. “Comparison of Synchronous PM Machine Types for Wide Constant-Power Speed Operation: Converter Performance”, *2006 International Conference on Electrical Machines (ICEM'06), Sept. 2-5, 2006, Chania, Greece*.
- (52) **A.M. EL-Refaie**, and T.M. Jahns," Comparison of Synchronous PM Machine Types for Wide Constant-Power Speed Range Operation”, *Rec. of the IEEE 2005 Industry Applications Annual Meeting, IAS 2005, Hong Kong, Volume 2,2-6 Oct. 2005 Pages:1015 – 1022*.
- (53) **A.M. EL-Refaie**, T.M. Jahns, Patrick J. McCleer, and John W. McKeever “Experimental Verification of Optimal Flux Weakening in Surface PM Machines Using Concentrated Windings” *Rec. of the IEEE 2005 Industry Applications Annual Meeting, IAS 2005, Hong Kong, Volume 2,2-6 Oct. 2005, Pages: 1050 – 1057*.
- (54) **A.M. EL-Refaie**, and T.M. Jahns," Scalability of Surface PM Machines with Concentrated Windings Designed to Achieve Wide Speed Ranges of Constant-Power Operation” *Rec. of IEEE International Electrical Machines and Drives Conference IEMDC 2005, San Antonio, TX, May 15, 2005, Pages: 1703 – 1709*.
- (55) **A.M. EL-Refaie**, and T.M. Jahns, "Optimal flux Weakening in Surface PM Machines Using Concentrated Windings" *Rec. of 2004 Industry Applications Annual Meeting, Volume:2, October 2004,Pages: 1038-1047, Seattle, WA*.
- (56) J.J. Nelson,G. Venjataramanan, and **A.M. EL-Refaie**, “Fast Thermal Profiling of Power Semiconductor Devices using Fourier Techniques” *Rec of. 2003 IEEE Applied Power Electronics Conference APEC 2003, Volume:2, Pages:1023-1028, Miami, FL*.
- (57) **A.M. EL-Refaie**, and T.M. Jahns,“ Application of Bi-State Magnetic Material to an Automotive IPM Starter/Alternator Machine ” *Rec. of 2003 IEEE International Electrical Machines and Drives Conference IEMDC 2003, Volume:3, Pages:1379-1387, Madison, WI*.

- (58) **A.M. EL-Refaie**, R. Manzke, and T.M.Jahns, " Application of Bi-State Magnetic Material to Automotive Offset-Coupled IPM Starter/Alternator Machine", *Rec. of 2003 Industry Applications Annual Meeting, Salt Lake City, UT.*
- (59) **A.M. EL-Refaie**, N.C. Harris, T.M. Jahns, and K.M. Rahman, " Thermal Analysis of Two-Barrier Interior Permanent Magnet Machine Using Lumped Parameter Model" *Rec. of International Conference on Electrical Machines, ICEM2002, Brugges, Belgium, August 2002.*
- (60) **Ayman M. EL-Refaie** "Current Energy Scene in Egypt, and the 21st Century Energy Options", *African Youth Energy Symposium organized by the World Energy Council (WEC), in Johannesburg, South Africa, September 1997.*

Patents:

- (1) US7504754 "Rotor having multiple permanent-magnet pieces in a cavity", March 17, 2009
- (2) US7541705 "Fault-tolerant permanent magnet machine with reconfigurable flux paths in stator back iron", June 2, 2009
- (3) US7605504 "Fault-tolerant permanent magnet machine with reconfigurable stator core slot flux paths", October 20, 2009
- (4) US7605503 "Fault-tolerant permanent magnet machine with reconfigurable stator core slot opening and back iron flux paths", October 20, 2009
- (5) US7622817 "High-speed high-pole count generators", November 24, 2009
- (6) US7652404 "Synchronous Reluctance Machine", January 26, 2010
- (7) US7750521 "Double-sided starter/generator for aircrafts", July 6, 2010
- (8) US7791237 "Fault-tolerant synchronous permanent magnet machine", September 7, 2010
- (9) US7994668B2 "COOLING SYSTEM FOR ROTATING MACHINE", August 9, 2011
- (10) US8004140 "DOVETAIL SPOKE INTERNAL PERMANENT MAGNET MACHINE", August 23, 2011
- (11) US8018110 "HIGH SPEED INTERNAL PERMANENT MAGNET MACHINE and method of manufacturing the same", September 13, 2011
- (12) US8063527 "Gas turbine engine assembly including dual sided/dual shaft electrical machine", Nov. 22, 2011
- (13) US08115434 "High-Speed Self-Cascaded Electric Machine", Feb. 14, 2012
- (14) US8,222,787B2 "Electric Machine" (Spoke Losses) , July 17, 2012
- (15) US8,222,855B2 "System and method for non-sinusoidal current waveform excitation of electrical machines", July 17, 2012
- (16) US8229682 "Apparatus and method for bearing condition monitoring", July 24, 2012
- (17) US8274190: Electric machine rotor bar and method of making same, September 25, 2012
- (18) US8310115 " High power-density, high-efficiency, non-permanent magnet electric machine:", Nov. 13, 2012

- (19) US8410656 “Segmented Stator Assembly”, April 2, 2013
- (20) US8466589 “Stator and method of assembly”, June 18, 2013
- (21) US8487489 “Apparatus for cooling an electric machine”, July 16, 2013
- (22) US8587164 “High power-density, high efficiency, non-permanent magnet electric machine”, November 19, 2013
- (23) US8633627 “Electric Machine”, January, 21, 2014
- (24) US8901896 “System and method for non-sinusoidal current waveform excitation of electrical generators”, December 2, 2014
- (25) US9093878B2 “Sensorless Electric Machine”, July 28, 2015
- (26) US9118271 “System and method for non-sinusoidal current waveform excitation of electrical generators”, August 25, 2015
- (27) US9287742 “Spoke permanent magnet machine with reduced torque ripple and method of manufacturing thereof”, March 15, 2016
- (28) US9,373,984 “ Electric Machine”, June 21, 2016
- (29) US 9,438,077 “Electric machine rotor bar and method of making same”, September 6, 2016
- (30) US 9,520,751 “System and method for smoothing a salient rotor in electrical machines”, December 19, 2016.
- (31) US 9,543,883 “Low-inductance, high-efficiency induction machine and method of making same “, January 10, 2017
- (32) EP2410639B1 “High power-density, high-efficiency, non-permanent magnet electric machine:”, June 11, 2014
- (33) EP2410639B1 “High-speed high-pole count generators”, June 27, 2012
- (34) EP2290810B1 “System and method for non-sinusoidal current waveform excitation of electrical machines’, June 25, 2014
- (35) EP2403129B1 “System and method for non-sinusoidal current waveform excitation of electrical generators”, August 13, 2014

Honors and Awards:

- (1) University of Wisconsin Madison
Morgridge Distinguished Graduate Fellowship, 1999
- (2) University of Wisconsin Madison
Research/Teaching Assistantship, 2000-2005
- (3) Cairo University
1995 Distinction with honors upon graduation (Ranked second out of 300), and receiving Cairo University Medal

- (4) Cairo University
Faculty of Engineering award for best M.Sc. Thesis in Electrical Power Engineering, 1998
- (5) 17 GE management awards.
- (6) GE Electronics and Energy Conversion “Rookie of the Year Award”, December 2006
- (7) GE Electronics and Energy Conversion “New technology Award”, February 2008
- (8) Selected for Who’s who in Science and Engineering, 10th Anniversary Edition.
- (9) **“2009 Forward Under Forty” award for outstanding University of Wisconsin Alumni under 40 (among 12 selected out of 163 nominees).**
- (10) **IEEE Industry Applications Society “Andrew W. Smith Outstanding Young Member Award 2009”**
- (11) GE Power Conversion Systems “Technical Achievement Award”, August 2010
- (12) IEEE Industrial Electronics Society Electrical Machines Committee Award for 2009 Prize Paper Award Reviewer
- (13) **2011 Hull Award Winner (Highest individual award for early career researchers at GE Global Research Center).**
- (14) GE Power Conversion and Delivery “New Technology Award”, February 2012
- (15) GE Technical Career Path (TCP) Excellence Award 2012
- (16) National Academy of Engineering (NAE) US Frontiers of Engineering Symposium 2012
Invited to attend the National Academy of Engineering (NAE) US Frontiers of Engineering Symposium – only 78 (selected out of 300) researchers from the US from all disciplines were invited
- (17) National Academy of Science (NAS) & NAE Brazil-US Frontiers of Science and Engineering
Invited to attend the First Brazil-US Frontiers of Science and Engineering Symposium (Brazil-US FOS&E) that will be held March 17-19, 2014, in Rio de Janeiro – only 60 (selected out of 30 US participants) researchers from the US from all disciplines were invited. First ever joint symposium of the NAS and NAE. First ever symposium in South America.

- (18) **IAS Electrical Machines Committee (EMC) Paper Award, First Prize 2013**
- (19) **International Conference of Electrical Machines (ICEM) 2014 Brian J. Chalmers Best Paper Award.**
- (20) GE 150 publications award, March 2016.
- (21) GE 25 issued patents award, March 2016.

Other Activities:

- Elected member Sigma Xi.
- Member SAE
- Keynote Speaker in the 2008 Ecological Vehicles and Renewable Energies International Conference and Exhibition, EVER 2008, Monaco. Also member of the conference program committee.
- Peer reviewer for the US DOE Vehicles Technology Projects 2009-2015
- Invited PhD committee member for Jagadeesh Tangudu at the University of
- TRIZ training February 2013
- Judge for Edison Awards 2012
- Advisory board member of Michigan GATE Center for Electric Drive Transportation at the University of Michigan-Dearborn
- Technical Program Committee (TPC) of the Ninth International Symposium on Linear Drives for Industry Applications (LDIA '2013)
- Member of the International Program Committee (IPC) of the 1st International Smart Grid Conference & Exhibition (ISGC&E 2013) organized by the Korean Institute of Electrical Engineers (KIEE), which was held from July 8th to 11th in Jeju, Korea.
- Invited panelist at IEEE International Transportation Electrification Conference, ITEC 2013, June 16-19, Dearborn, MI
- Invited Speaker at the “JMAG Users Conference”, December 4-5, 2013, Tokyo, Japan
- Invited speaker for the 15th anniversary of the IEEE PES/PELS/IAS Joint Student Chapter Branch at Texas A&M University, April 2014
- Invited Plenary Speaker, the 2015 Ecological Vehicles and Renewable Energies International Conference and Exhibition, EVER 2015, March 2015, Monaco
- Board of Director EMERF (part of SMMA)
- Invited reviewer by NSF, Jan. 2015
- Technical Program Committee of International Conference on Sustainable Mobility Applications, Renewables and Technology (SMART2015), November 23-25, 2015, Kuwait
- Invited Plenary Speaker, IEMDC 2015, May 2015, Coeur d'Alene, Idaho