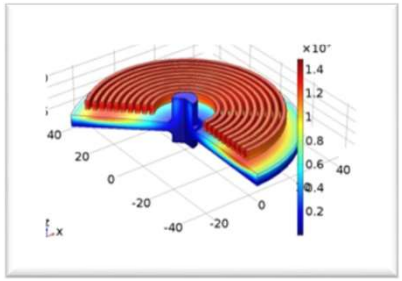
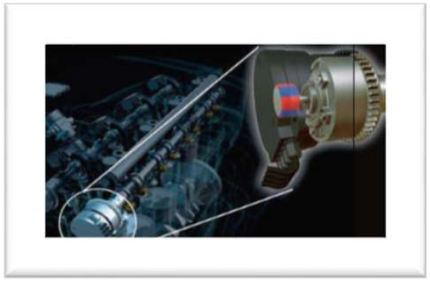
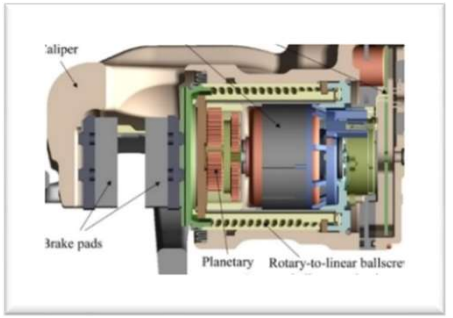
Hybrid utility truck
Source: eaton.com



Thompson-coil circuit breaker
Source: IEEE ECCE 2015



Electric cam phaser
Source: Delphi (IEEE MTZ Zeitschtrift, 2012)



Electric brake
Source: Delphi (IEEE IAS Mag, 2009)

Bruno Lequesne, PhD, Fellow IEEE

E-Motors Consulting, LLC

www.emotorseng.com

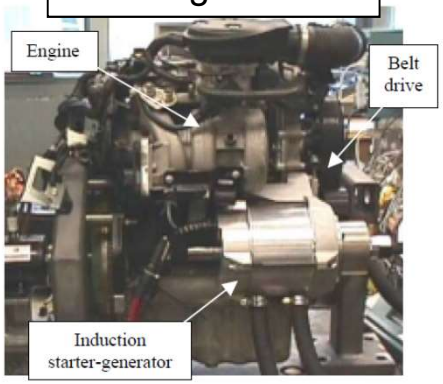
Employment history

- 40+ years in automotive research and advanced engineering
- Independent consultant (E-Motors Consulting, LLC): 2014
- Eaton: 2010-2014
- University of Alabama: 2009-2010
- Delphi Research, Delphi Advanced Powertrain Group: 1999-2009
- General Motors Research Labs: 1984-1999
- Chair, IEEE Transportation Electrification Community (2019-2020)
- President, IEEE- Industry Applications Society: 2011-2012
- Education, Electrical Engineering:
  - Missouri University of Science and Technology, PhD, 1984
  - Ecole Supérieure d'Electricité, France, 1978

Expertise: Electric drives and electromagnetism

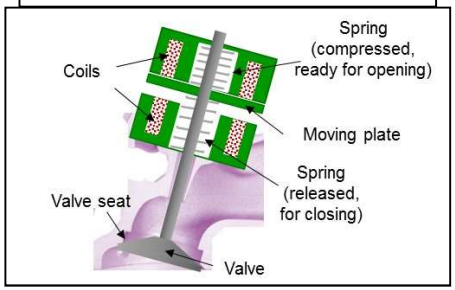
- Electric machine design
  - Permanent magnet and induction motors as a consultant
  - Permanent magnet motors (e.g, for valve actuation, while at GM)
  - Induction motor (e.g., starter-generator, at GM, Delphi)
  - Switched reluctance motor controls (e.g., for brakes, at Delphi)
- Linear actuators
  - Linear motors, oscillatory actuators (e.g., valve actuators, at GM)
  - Control solenoids (e.g., fuel injectors, at GM)
- Sensor concepts
  - Position, based on Hall effect or variable reluctance (e.g., ABS, engine position, steering, at GM and Delphi)
  - Torque (e.g., for electric power steering, at Delphi)
  - Force, pressure, based on magnetostriction (e.g., for brakes, engine pressure, at Delphi)
- Electromagnetic simulation

Starter generator



Source: IEEE TIA, 2002

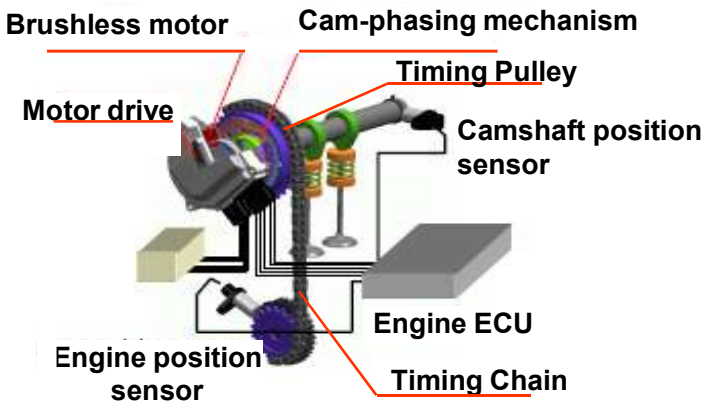
Engine valve actuator



Expertise: Systems

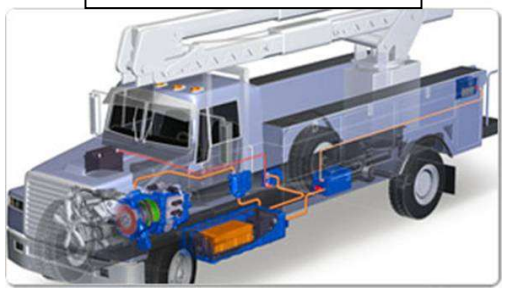
- Electro-mechanical systems
  - For example, valvetrains: How to best electrify valve trains, from cam phasers to fully variable valve actuation (while at Delphi)
- Transportation electrification
- Hybrid systems
  - Starter-generators (while at GM, Delphi)
  - Commercial vehicles (while at Eaton)
  - Hybrid configurations (now at E-Motors)
- Micro-hybrid power generation

Engine cam phaser system



Source: denso.com

Hybrid utility truck



Source: eaton.com

Expertise: Management

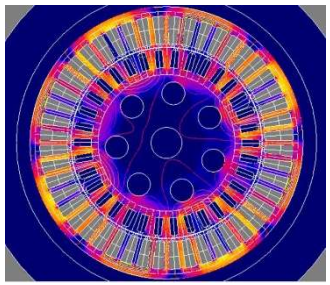
- Chair, IEEE Transportation Electrification Community (2019-2020)
  - Volunteer position
  - The Transportation Electrification Community is tasked with coordinating all activities within IEEE concerning this technical field
- President, IEEE Industry Applications Society (2011-2012)
  - Volunteer position (supported by employer)
  - Technical engineering society; 11,000 members, $3M budget
  - During tenure (2011-2012):
    - Oversaw creation of 3 technical committees (+10%)
    - Creation of 3 new journals
- Delphi Advanced Powertrain (2006-2009)
  - Group manager for development of new concepts in valvetrains, sensors, and fuel systems
- Project management throughout career

Expert witness experience

- Crandall Technologies LLC v. Greatcall, Inc., infringement case, 2019
- MPC Inc. v. Standex Electronics Inc., warranty dispute between two automotive suppliers, 2019
- Patent litigation case concerning electric motors for automotive applications, 2018
- AM General, LLC v. UUSI, LLC, 4 IPR cases, with deposition, 2016-2017
- SD3 LLC v. US PTO, with deposition and testimony at trial (US District Court), 2016

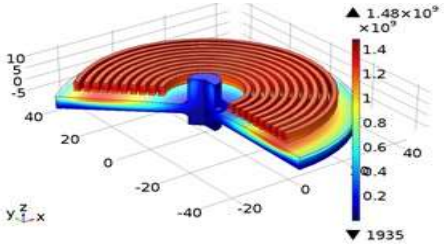
Recent projects (E-Motors Consulting)

- Automotive systems:
  - Evaluation of electrical drive systems for hybrid applications
  - Motor designs for a Tier 1 automotive supplier
  - Role of magnetic hysteresis in actuator performance
- Aerospace:
  - Electric machine design for pump application
- Renewable energy:
  - Project manager for a start-up working on small hydro generation (under Dept. of Energy grant)
- Actuators:
  - Fast electromagnetic actuation for DC circuit breaker
- Expert witness with trial experience



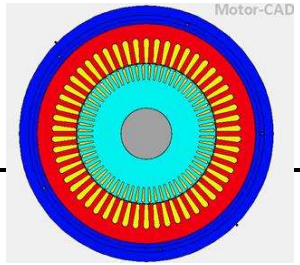
Induction motor (400 Hz)

Prototype turbine for small hydro (with Cadens, LLC)



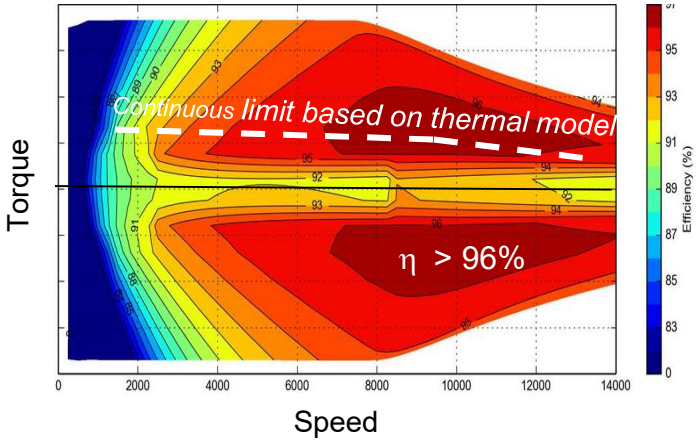
Thompson coil actuator (Trans. on Industry Appl., 2016)

Modeling tools

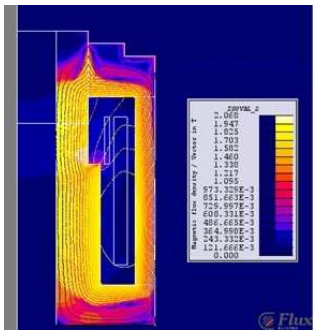


Traction motor

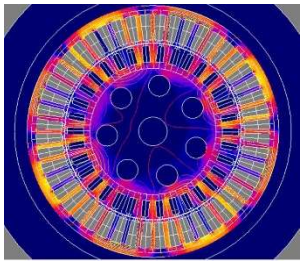
- Motor modeling: MotorCAD
  - Permanent magnet and induction
  - Electromagnetic and thermal models
  - Based on both closed form and finite element



- Finite element: Flux from Altair



Linear solenoid actuator



Aerospace motor

Awards

- IEEE Tesla award, 2016
  - “For contributions to the design and analysis of actuators, sensors, and motors for automotive applications”
- IEEE Fellow, 1997
  - "For contributions to the development of electromechanical actuators for automotive applications".

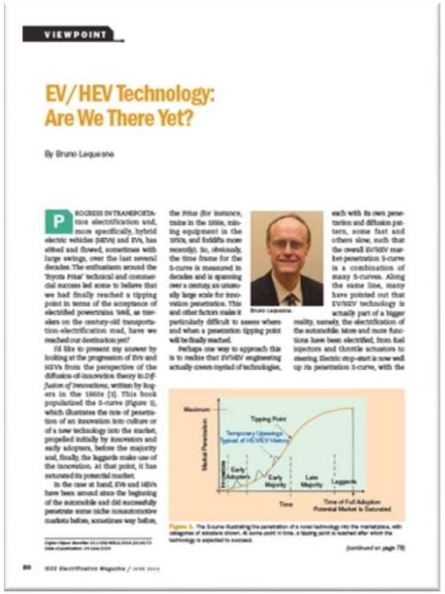
Source: ieee.org

- IEEE Industry Applications Society, Gerald Kliman Innovator Award, 2007
- Best Paper awards:
  - IEEE Industry Applications Society, Second Prize Transactions Paper Award, 2016
  - IEEE Industry Applications Society, Second Prize Transactions Paper Award, 1996
  - IEEE Industry Applications Society, Electric Machines Committee, Best Paper Awards: 6 awards, 1987-2005
  - Society of Automotive Engineers:
    - SAE Vincent Bendix Automotive Electronics Engineering Award, 2006
    - SAE Arch T. Colwell Award, 2000
    - Excellence in Oral Presentation, 1998

Publications

Available at: http://www.emotorseng.com/selected-papers-and-presentations/
or for patents at: https://www.google.com/?tbm=pts&gws_rd=ssl#tbm=pts&q=lequesne+bruno

- Patents: 53
- Papers (most recent)
  - "Active damping of ultra-fast mechanical switches for hybrid AC and DC circuit breakers", C. Peng, L. Mackey, I. Husain, A. Huang. W. Yu, B. Lequesne, R. Briggs, IEEE Trans. on IA, Vol. 53, No. 6, Nov./Dec. 2017
  - "A fast mechanical switch for medium voltage hybrid DC and AC circuit breakers", C. Peng, I. Husain, A. Huang. B. Lequesne, R. Briggs, IEEE Trans. on IA, Vol. 52, No. 4, July/Aug. 2016
  - "Automotive electrification: The non-hybrid story", invited paper, IEEE Transactions on Transportation Electrification, May 2015
- Presentations (recent)
  - "Electric machines for automotive propulsion: History and future", keynote presentation, IEEE ITEC-Asia-Pacific 2019, May 2019.
  - "Automotive motors: Recent accomplishments and challenges ahead", Presentation at Special Session at IEEE Energy Conversion Conference & Exhibition (ECCE), 09-2016.
  - "Automotive electrification: The non-hybrid story", Keynote presentation, IEEE International Transportation Electrification Conference, 06-2015.


VIEWPOINT

EV/HEV Technology: Are We There Yet?

By Bruno Lequesne

Customers


Delco
Remy


BorgWarner


neapco


Shark NINJA


TWIN DISC


ESi


CHORE-TIME


Cadens
LLC


Therma-Stor LLC
Driven by performance. Powered by design.™


MAGSOFT
CORPORATION


GM


DENSO


Standex
Electronics


EATON
Powering Business Worldwide™


HARTRON


von Briesen

greatcall


MOTORS
Consulting, LLC

Summary

- Seasoned researcher, inventor, engineer and manager in the field of electric drives, actuators, sensors and electro-mechanical systems

- Expert in automotive and transportation electrification
  - Including expert witness with court experience

- Consulting on:
  - Technology roadmapping and strategizing, discerning new trends
  - Development of new concepts and products
  - Design of electric machines, linear actuators, and sensors
  - Intellectual property analysis and strategy, expert witness