

Michael C. Lewis



Position: Senior Engineering Scientist

Biography

Mr. Michael Lewis has over 20 years of experience in advanced research and technology development at the University of Texas, Center for Electromechanics (UT-CEM). Mr. Lewis' early research responsibilities were primarily focused on the development of a prototype advanced high-speed generator for an electromagnetic aircraft launching system. Under this program, Mr. Lewis was responsible for the mechanical design of a high-speed rotor, which included novel materials and design approaches that required extensive testing and research before implementation. In addition, he was also responsible for the modeling and analyses essential to the development of the generator, including airflow network analysis, 3D electromagnetic modeling, and structural finite element analysis.

Mr. Lewis' current research interest focus on alternative fuels for transportation and stationary power applications with a large focus on hydrogen power and energy systems. His team has developed, built, and tested fuel cell hybrid vehicles ranging from small neighborhood electric vehicles, to transit buses, to medium and heavy duty trucks. This research has expanded beyond vehicle prototypes to also include novel materials based hydrogen generation, alternative storage vessel technologies, and the use of linear motor driven compressors and expanders for various applications, including hydrogen refueling and active recovery of methane leaks for large pipeline networks. An overarching

mission of Mr. Lewis and his research team is to advance the state of these alternative fuel technologies and provide technology transfer to industrial partners, which will accelerate the adoption and commercialization of alternative fuels for transportation.

Mr. Lewis is currently leading UT-CEM's efforts on a Department of Energy H2@Scale award that will demonstrate renewable pathways for hydrogen production and distribution and enable cost effective hydrogen for transportation and industrial applications. In addition, this project will also study the opportunities for a hydrogen energy economy in Texas and the Gulf Coast region.

Education

- M.S., Mechanical Engineering, The University of Texas at Austin, 2007
- B.S., Mechanical Engineering, The University of Texas at Austin, 1999

Current Projects

- H2@Scale demonstration and framework for Texas and Beyond
- Hydrogen fuel cell delivery van development and demonstration
- Linear expander development for precooling at hydrogen refueling stations
- Linear expander and compressor for smart CNG refueling
- Linear motor driven compressor for nuclear air treaty monitoring
- Linear motor compressor for methane leak recovery
- Hydrogen generation for remote applications using nano-galvanic aluminum
- Flywheel energy storage for off-road equipment

Research Areas/Areas of Interest

- Alternative fuels for vehicles – batteries, ultra-capacitors, hydrogen fuel cells, natural gas
- Power and energy systems modeling and control for hybrid electric vehicles and eVTOL aircraft, as well as industrial power plants and renewable power sources
- Hydrogen and natural gas storage and delivery and refueling
- Flywheel energy storage and advanced composites
- Novel applications for electric machines, including linear motor applications for gaseous compression and expansion

About Me

- Avid marathon and ultra-marathon runner

Selected Publications

1. M. Lewis, X. Feng, J. Hanlin, M. Field, and J. Ambrosio, A. Mabrey, "Model Validation and Demonstration of a Hydrogen Fuel Cell Parcel Delivery Truck," Proc. of 2020 IEEE Transportation Electrification Conference and Exposition (ITEC), Chicago, IL, June 2020.
2. C. Penney, M. Lewis, M. Boothe and S. Thompson, "Design, Installation, and Testing of a Paratransit Bus with Electrified Accessories," *2019 IEEE Transportation Electrification Conference and Expo (ITEC)*, Detroit, MI, USA, 2019, pp. 1-5.
3. A. Chapman, K. Itaoka, K. Hirose, F. Todd Davidson, K. Nagasawa, A. C. Lloyd, M. E. Webber, Z. Kurban, S. Managi, T. Tamaki, M. C. Lewis, R. E. Hebner, Y. Fujii, "A review of four case studies assessing the potential for hydrogen penetration of the future energy system," *International Journal of Hydrogen Energy*, Volume 44, Issue 13, 2019, Pages 6371-6382, ISSN 0360-3199, <https://doi.org/10.1016/j.ijhydene.2019.01.168>.
4. M. Lewis, C. Hearn, X. Feng, J. Hanlin, J. Levin, and J. Ambrosio, "Design and modeling for hydrogen fuel cell conversion of parcel delivery trucks," Proc. of IEEE Transportation Electrification Conference and Exposition (ITEC), Chicago, IL, June 2017.
5. X. Feng, M. Lewis, and C. Hearn, "Modeling and validation for zero emission buses," *Proc. of IEEE Transportation Electrification Conference and Exposition (ITEC)*, Chicago, IL, June 2017, pp. 1-6.
6. C.S. Hearn, M.C. Lewis, S.B. Pratap, R.E. Hebner, F.M. Uriarte, D. Chen, and R.G. Longoria, "Utilization of Optimal Control Law to Size Grid-Level Flywheel Energy Storage," *IEEE Transactions on Sustainable Energy*, Vol. 4, No. 3, July 2013.
7. C.S. Hearn, M.C. Lewis, R.T. Thompson, et al., "Design and demonstration of an extended range hydrogen fuel cell utility vehicle," *Vehicle Power and Propulsion Conference*, Chicago Illinois, USA, September 6-9, 2011.
8. C.S. Hearn, M.C. Lewis, R.C. Thompson, and R.G. Longoria, "Modeling and Evaluation of a Plug In Hybrid Fuel Cell Shuttle Bus," *5th IEEE Vehicle Power and Propulsion Conference (VPPC'09)*, Dearborn Michigan, USA, Sept. 7-11, 2009.
9. R.C. Thompson, R.E. Hebner, B.T. Murphy, J.H. Beno, J.D. Herbst, R.J. Hayes, M.M. Flynn, C.S. Hearn, M.C. Lewis, "Flywheel energy storage for passenger vehicles, trucks, and buses," UT Tech ID 5540-THO, submitted October 2008.
10. C. Hearn, M. Flynn, M. Lewis, R.C. Thompson, et al., "Low cost flywheel energy storage for a fuel cell powered transit bus," *2007 IEEE Vehicular Power and Propulsion Conference*, Arlington, Texas, USA, Sept. 9-12, 2007.
11. M.M. Flynn, C. Hearn, M. Lewis, R.C. Thompson, and R. Longoria, "Prime mover and energy storage considerations for a hydrogen-powered series hybrid shuttle," *2007 IEEE Vehicular Power and Propulsion Conference*, Arlington, Texas, USA, Sept. 9-12, 2007.
12. M.C. Lewis, "The use and fabrication of high strength alloy steel laminations in rotating electrical machines," *Classified Seminar on the Applications of Electromagnetic Launch Technology*, Washington, DC, USA, May 2-4, 2007.

13. M.C. Lewis, "Structural limitations of VPI resins at class H operating temperature," Classified Seminar on the Applications of Electromagnetic Launch Technology, Washington, DC, USA, May 2-4, 2007.
14. M.D. Werst, J.A. Pappas, R.C. Zowarka, J.R. Kitzmiller, and M.C. Lewis, "Railgun design methodology," Classified Seminar on the Applications of Electromagnetic Launch Technology, Washington, DC, USA, May 2-4, 2007.
15. H-P. Liu, R.D. Lenhart, M.C. Lewis, M.D. Werst, and R.C. Zowarka, "Energy storage generator thermal analysis for an electromagnetic aircraft launch system," Classified Seminar on Applications of Electromagnetic Launch Technology, Washington, DC, USA, May 2-4, 2007.

Patents

1. J. Stair, T. Lindsay, M. Lewis, R. Zowarka, S. Pratap, C. Hearn, C. Penney, M. Worthington, H.P. Liu, "Free Piston Linear Motor Compressor and Associated Systems of Operation," Patent Application Pub. No. US2015/0125323 A1, May 7, 2015.