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Perpetual Motion

Ali Emadi keeps busy with all things EV

By SUSAN KARLIN 9 September 2011



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Sustainable energy is an appropriate field for Senior Member Ali Emadi, considering the nonstop research, published articles, and edited manuscripts he has managed to cram into the past 11 years—not to mention the conferences he helped organize.

Photo: Ryan Maneri/Oystercatcher Media

First, at the Illinois Institute of Technology (IIT) in Chicago—where he was a chaired professor of engineering—he turned his lab into a world-class power electronics research center. Then he founded a company in 2005 to commercialize the technologies developed in the lab, including a new kind of electric motor. In late 2009, his hard work caught the attention of McMaster University, in Hamilton, Ont., Canada. McMaster offered him a job as a research chair in hybrid power-train systems. He accepted, starting this past May, and things haven't slowed down for him.

Before he had even unpacked all the boxes in his new office, he was planning the IEEE Power Electronics Society's [Transportation Electrification Conference and Expo \(ITEC\)](http://itec-conf.com/)—IEEE's first transportation- industry-focused conference on sustainable energy. It is scheduled for June 2012 in Dearborn, Mich. Emadi is the conference chair.

All the work has been a juggling act, which leaves him more giddy than overwhelmed, he says. “When you have fun, having so much work is okay,” he explains. “I’m lucky in that regard. I’ve been fascinated by electronics, systems, and cars since I was a kid. Sometimes I can’t believe I’m getting paid for what I’m doing.”

J E F B T I F Y D I B O H F

What he's doing is working toward the lofty goal of shifting vehicles from petroleum products to electricity. And he's focusing increasingly on electricity from cleaner sources than coal, such as the sun, wind, and water. With

ITEC, Emadi says he hopes to get the makers of cars, off-road vehicles, trains, ships, and even spacecraft together with academics so they can exchange ideas to expedite that transition.

“Our conference is heavily industry-oriented, although it will facilitate interaction between companies and researchers,” he says. “It’s unique in its focus on the intersection of all types of transportation products and components and ways to leverage technologies between them. There will be more than 200 presentations and research papers by industry representatives.

“Electric power, over time, will come from more renewable energy sources. Clean coal plants, which have better filters and technologies and less emissions, are also part of the solution.”

A major component of ITEC is its Educational Bootcamp, in which engineers and managers from industry offer classes on the basics of transportation electrification.

“There’s a desperate need to educate engineers on the new technologies as well as on the fundamentals of power electronics and electric machines,” Emadi says. “These classes are focused on industry fundamentals and won’t interfere with company secrets.”

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Emadi has been interested in power electronics converters and systems since he began his academic training. He earned bachelor’s and master’s degrees from Sharif University of Technology, in Tehran, in 1995 and 1997 and a Ph.D. in 2000 from Texas A&M University, in College Station.

Immediately after graduating, he joined IIT as a professor of electrical and computer engineering and went on to develop its Electric Power and Power Electronics Center and Grainger Laboratories, which aims to develop more efficient electric motors.

His research there led to nine automotive application patents (with three others pending). In 2005, he founded Hybrid Electric Vehicle Technologies to commercialize the university lab’s creations. One of the most promising technologies involves a reconfigured switched-reluctance electric motor that improves efficiency without permanent magnet materials (used to generate the magnetic flux that creates torque).

“The electric motors of most hybrid and electric cars use permanent magnets,” he says. “Aside from being expensive, most of these permanent magnets are made from rare earth materials, whose refining is not a clean process.”

Meanwhile, Emadi has authored or coauthored more than 250 journal and conference papers as well as half a dozen books, most recently *Integrated Power Electronic Converters and Digital Control* (CRC Press, 2009). He is chair of three IEEE committees and is the North American editor of the *International Journal of Electric and Hybrid Vehicles*. He has been a guest and associate editor on half a dozen other publications and special issues, and he chaired two other IEEE conferences. Along the way, he garnered seven awards and

recognitions, including three from IEEE, and was named a 2009 Chicago Matters Global Visionary, an award for area residents who help shape the region's future and global reputation.

Canada came calling in 2009 as part of a government initiative to attract some of the world's top researchers in 19 scientific areas to 13 universities. Each appointment receives up to US \$10.2 million in federal funding over seven years. Emadi's is the only position related to the automotive industry, which, he notes, accounts for a significant portion of Canadian exports. His duties include directing the university's Institute for Automotive Research and Technology, which encompasses roughly 75 researchers and gets \$100 million in funding.

"No matter what your viewpoint, sustainable energy is something you should support," he says. "Our current transportation system is too heavily dependent on fossil fuels and is at the mercy of oil prices. If you care about the environment, you'll want to reduce emissions."

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