Designing, Building and Testing an Electric Motorcycle for the Most Dangerous and Oldest Motorcycle Race in the World

This seminar will describe the process of designing, building, and testing a high performance electric motorcycle for the 2011 Isle of Man Tourist Trophy (TT) Zero race. The TT race is the oldest existing motorcycle race (est. 1907), and is known for high speeds, over 200 sharp turns, and danger to the rider. These demands created a challenge to engineer a machine that was capable of finishing the entire course on a single battery charge in the fastest time possible. The design process consisted of systems engineering, subsystem design, final system design, testing, and model validation. Simulations were useful for understanding how the design parameters affect performance metrics. "Full throttle" simulations were performed to estimate the maximum acceleration, speed, and power of the motorcycle. To estimate the energy required to traverse the entire course, it was necessary to make assumptions about the throttle profile, speed, or power. The electrical and mechanical designs of the motorcycle used mostly off-the-shelf components, though custom designs were generated for the instrumentation, motor shaft and structural frame that housed the motors and batteries. Real-time sensing provided a rich data set that was used to validate the models; it was found that the models were able to predict the acceleration, maximum speed, and energy consumption to within 10% of the actual values.

About the presenter:

Lennon Rodgers is a researcher from the International Design Center at the Massachusetts Institute of Technology (MIT). His PhD (2013), M.S. and B.S. degrees are all in mechanical engineering. His research focuses on modeling and instrumenting complex systems. Lennon also worked on large ground based telescopes at Caltech and the Jet Propulsion Laboratory.