PURDUE UNIVERSITY | Environmental and Ecological Engineering

EEE Research Seminar

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Parametric Design, LCA and TEA, and Optimization of a Discrete Product with Application to an Electric Traction Motor

Abstract

Humans are surrounded and even dependent on discrete products for their daily activities. Product design processes have been vastly studied towards a healthy economic prosperity and other technical objectives. However, recent studies show that these methods have been lacking in terms of the environmental challenges humanity faces in the present and future. This study proposes a novel parametric design framework that incorporates a life cycle assessment (LCA) and techno-economic assessment (TEA) as part of the optimization-based design model of a discrete product at early stage. Electric traction motor design applied to an electric vehicle is used as a case study. The results of performing a multi-objective design problem and an uncertainty analysis using Monte Carlo simulation show the usefulness of incorporating the LCA in a transparent manner, as required by the International Standards Organization. Future work suggests investigating the expansion of this technique to support cutting-edge research such as the implementation of the Circular Economy Paradigm for discrete products in the long-term.

Bio

Jesús R. Pérez-Cardona has a B.S. degree in Mechanical Engineering from the University of Puerto Rico, Mayagüez Campus, and a M.S. degree in Environmental and Ecological Engineering from Purdue University, West Lafayette, IN, where he is currently a Ph.D. candidate. His research interests are in design and manufacturing for sustainability, manufacturing processes and systems, renewable energy systems, techno-economic assessment, life cycle assessment, and circular economy.