

A framework of Computer Aided Engineering and LCA applied for Life Cycle Management

Prof. Sergio Romero-Hernández,

Instituto Tecnológico Autónomo de México, Industrial Engineering Department
sromero@itam.mx;

Prof. Omar Romero,

Instituto Tecnológico Autónomo de México, Industrial Engineering Department
oromero@itam.mx;

The present paper is concerned with an integrative approach related to (i) the use of modern CAD and CAE tools, for early effective product design, and (ii) an environmental management framework that evaluates the environmental performance of the product along its whole life cycle (raw materials selection, materials transformation, production processes, transportation, use, re-use, recycle, retirement/decommissioning). The main result is a conceptual and research-based framework for multidisciplinary life cycle management.

The presented research provides a high-end technical solution to determine the best product alternative in terms of market expectations, product-process specifications, economic and environmental impact in the long term, that is, along the whole life of a product. The integration of this framework is oriented towards rapid generation of prototypes and evaluation of innovative products.

In order to achieve this objective, we have developed two inter-connected sub-frameworks: (i) a sub-framework for total computer aided engineering (TCAE), which allows for designing an optimised product alternative, taking into account the need to come up with a fast, reliable design and prototype, and (ii) a sub-framework that could be used to consistently evaluate and compare the economic and environmental performance of every product alternative.

This framework was successfully applied into a experimental high speed rotor prototype . The main results showed that an optimised design can be achieved in the early stages of the design process, by combining computer aided tools for design, analysis and predictions in a feed-back process loop which allowed the development of a product in a faster, cost effective and environmentally friendly manner. Furthermore, the framework developed in this paper can be effectively applied into almost any product design project.