Multi-objective optimization for high recyclability material selection using genetic algorithm

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Abstract

Material selection plays an important role in product design. A design demands specific material properties in order to fulfill its functional requirements and to minimize its detrimental impact on the environment. Hence, much effort has been devoted to the recyclability of a product at the end of its life during product design. It is the responsibility of the designers to incorporate recyclability considerations during product design to ensure that a certain level of recyclability is attained at the end of a product's life as imposed by legislation. The complex relationships between different selection parameters complicate the material selection process. Designers are faced with the challenge of selecting suitable materials that could satisfy cost and functional and environmental performance. Therefore, solving material selection in respect of satisfying product recyclability is an area worthy of investigation. This paper attempts to propose an approach that could facilitate designers to select recyclable materials as well as reducing the complexities in decision making. In this paper, the use of a genetic algorithm is proposed to optimize the multi-objective problem in the selection of recyclable materials. A case study on the automobile's side mirror is used to demonstrate this approach.

Keywords Material selection, Recyclability, Recyclable material selection, Genetic algorithm