

Sustainable manufacture of scalable product families based on modularity

Mesa J.

Pierce J.

Zuniga J.

Esparragoza I.

Maury H.

Abstract

This article presents a redesign methodology based on modularity to minimize resource consumption and reuse components, avoiding the need to replace a whole product with another with higher functional performance. The method employs two decision algorithms to modularize product families that offer the same functionality in different levels (i.e., scalable functions) based on design parameters such as geometry, size, and functional relationships among components. The proposed approach's benefits are demonstrated through a case study of a family of upper limb prostheses. Significant improvements in the manufacturing stage, such as raw material and energy consumption, manufacturing cost, and complexity, were obtained from implementing the method. Other benefits in the use stage were also obtained from modularization, increasing the product family's reuse of components. © 2021 CIRP

Author keywords

Circular economy; Manufacturing; Modularity; Product design; Product family; Sustainability