

Layout optimization method considering disassemblability for the facilitation of reuse and recycle

Masakazu Kobayashi¹, Masatake Higashi²

¹ Toyota Technological Institute, Nagoya, Japan, kobayashi@toyota-ti.ac.jp

² Toyota Technological Institute, Nagoya, Japan, higashi@toyota-ti.ac.jp

Abstract

Due to rise of environmental awareness and enactment of legislation in recent years, end-of-life products need to be collected, disassembled and reused / recycled. However, since every component that comprises the product is not reused / recycled from a cost effective standpoint, there is no need to completely disassemble the product and only components to be reused / recycled need to be removed from the product with minimum disassembly cost and work. The number of tasks required to remove each component from the product is seriously affected by its position inside the product and positional relationships between surrounding components. Layout of components inside a product is roughly decided during conceptual design phase. So it is desirable to decide components layout with consideration of disassemblability during conceptual design phase. In this research, we focus on layout design during conceptual design phase and develop a new method of optimizing component layout considering disassemblability. In the proposed method, sequence triple is used to represent a three-dimensional component layout inside a product. To evaluate disassemblability of the generated layout, objective function is defined based on the number of tasks required to remove components from a product and the value of those components. Optimal layout is explored by using genetic algorithm. Since some components need to be placed next to particular components, adjacency between components is evaluated and handled as constraint conditions. In the case study, the proposed method is applied to the layout design of internal components of a laptop computer.