

A disassembly model for end-of-life products recycling – Tsai-Chi Kuo

The proposed research focuses on reducing the volume of solid waste and extending the life cycle of nature's resources. Today, most electromechanical products cannot be recycled because they cannot be easily disassembled. Simultaneously dealing with the disassembly constraints, cost, and material problems during recycling are critical challenges. This research develops a method based on environmentally conscious design and manufacturing to enhance the recyclability of end-of-life (EOL) products, generate efficient disassembly plan, evaluate recycling strategies, calculate recycling cost, and indicate environmental impact. Furthermore, the research also provides design support to help in designing new products.

The research is based on a graph representation to evaluate the disassemblability/reusability/recyclability. Information needed in this model consists of (1) disassembly recognition/representation and planning (e.g., product model recognition and representation, modularity analysis, and disassembly tree construction), (2) cost calculation and minimization (e.g., disassembly sequence generation logic for target disassembly, optimal disassembly, and completely disassembly, schemes for determining disassembly termination, strategies of recycling method plan, and calculation of recycling cost), (3) design support and environmental impact evaluation (e.g., material evaluation, disassembly ability, recyclability, and material assessment), and (4) database and database management to support this disassembly model. Thus, the problem of identifying the optimal disassembly and recycling strategy is transformed into a graph search problem. By solving the graph search problem, one can determine the termination of disassembly, generate the disassembly sequence, calculate the disassembly cost, select recycling plans, monitor the material flow, evaluate environmental compatibility of the product, and provide design support information. This research will help manufacturers solve disposal problems by reducing the life cycle cost and more reusable/recyclable products will no longer go to landfill.

