ENHANCING REMANUFACTURABILITY THROUGH TRIZ-BASED APPROACH

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Abstract

Design for remanufacturing aims to improve product designs to enhance the economic and environmental sustainability of remanufacturing operations. Generating practical design ideas for remanufacturing requires a comprehensive understanding of the product manufacturing processes with constraints and applying a systematic approach to identifying feasible design changes. Theory of Inventive Problem-Solving (TRIZ) offers a systematic, knowledge-based problem-solving methodology, which could be used to address complex design challenges and generate alternative solutions for remanufacturing. Because TRIZ principles are derived through screening thousands of patents across diverse industries, these principles can be applied in a wide range of manufacturing systems. The design generation stage can be systematic and straightforward by utilizing the basic inventive problem-solving principles and considering the product- and manufacturing-specific constraints. This study focuses on the transmission control unit in electronic vehicles, which is responsible for controlling the calculation of when and how to change the gear. The current design needs improvement for disassembling the returned products, particularly in separating components, without the risk of damaging the printed circuited board - a critical, economically valuable component. Consequently, design improvement focuses on easing the disassembly process without harming the reusable components. To achieve this, brainstorming sessions are conducted with the engineering team to define the problem in terms of technical contradictions within the TRIZ framework. Then, using the TRIZ matrix, feasible design changes to solve these contradictions are identified. Each design change is evaluated based on ease of applicability and compatibility with the current manufacturing setup. The entire idea generation process and resulting design improvement options are presented to inform remanufacturing practitioners about the usability of the TRIZ methodology in systematically enhancing design solutions.

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Primary topic: Design for Remanufacturing & Recycling for the Circular Economy

Secondary topic: Building a Sustainable Circular Economy for Materials & Products