Multi-Robotic Partial Disassembly Line Balancing with Robotic Efficiency Difference via HNSGA-II

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Abstract : To accelerate the remanufacturing process of electronic waste products, this study designs a partial disassembly line with the multi-robotic station to effectively dispose of excessive wastes. The multi-robotic partial disassembly line is a technical upgrade to the existing manual disassembly line. Balancing optimization can make the disassembly line smoother and more efficient. For partial disassembly line balancing with the multi-robotic station (PDLBMRS), a mixed-integer programming model (MIPM) considering the robotic efficiency differences is established to minimize cycle time, energy consumption and hazard index and to calculate their optimal global values. Besides, an enhanced NSGA-II algorithm (HNSGA-II) is proposed to optimize PDLBMRS efficiently. Finally, MIPM and HNSGA-II are applied to an actual mixed disassembly case of two types of computers, the comparison of the results solved by GUROBI and HNSGA-II verifies the correctness of the model and excellent performance of the algorithm, and the obtained Pareto solution set provides multiple options for decision-makers.

Keywords : waste disposal, disassembly line balancing, multi-robot station, robotic efficiency difference, HNSGA-II
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