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A Multi-Objective Optimization for Brush Monofilament Tufting Process Design

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Abstract. This paper addresses the optimization of monofilament tufting process as the most important and the main stage of toothbrush production in sanitary industries. In order to minimize both process time and depreciation costs, and ultimately increase the production efficiency in such an industrial unit, we propose a metaheuristic based optimization approach to solve it. The Traveling Salesman Problem (TSP) is used to formulate the proposed problem. Then by using multi-objective evolutionary algorithms, NSGA-II and MOPSO, we seek to obtain the best solution and objective functions described above. Extensive computational experiments on three different kinds of toothbrush handles are performed and the results demonstrate the applicability and appropriate performance of algorithms. The comparison metrics like spacing, number of Pareto solutions, time, mean distance from the ideal solution and diversity are used to evaluate the quality of solutions. Moreover a sensitivity analysis is done for investigation of the performance in various setting of parameters.

Keywords: Monofilament Tufting, Traveling Salesman Problem, Multi-Objective Optimization, NSGA-II, MOPSO.

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