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INTELLIGENT TOOLPATH SEQUENCE OPTIMIZATION APPROACH FOR INFINITE PRODUCTION LINES

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Abstract

This thesis is concerned with developing a new mathematical model and software for finding the optimal toolpath for an infinite machine production line system. Existing total production time estimation for the computer numerical control (CNC) machining method is solved either on a single machine or in a single operation. The combination of airtime and tool switching time consumes most of the total production time, requiring multiple operations and multiple machine production line systems. A hybrid GA technique along with a modified TSP algorithm was used to find the minimal nonproductive time in these systems. This proposed mathematical model is coded with a C++ program, and user-friendly software has been developed in this study. It was found that the total production time for multiple machining operations was significantly reduced with this technique by eliminating the unwanted cutting tool switches in the machine unit and between multiple machines. The numerical simulation conducted in this research shows that the proposed approach is feasible and practical. It is beneficial, especially in real-time manufacturing process outlines and scheduling multiple systems such as aerospace parts manufacturing, IC chip, Insertion units, job sequencing etc. by minimizing the non-productive time and thus increase the production rate.