

**TOOLPATH OPTIMIZATION USING ANT COLONY OPTIMIZATION AND
PARTICLE SWARM OPTIMIZATION FOR COMPLEX MACHINING WITH
MULTIPLE ENTRY AND EXIT POINTS**

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MASTER'S DEGREE
in

Master of Mechanical Engineering
ENGINEERING AND INFORMATION TECHNOLOGY



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JULY 2024

STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.

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ABSTRACT

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This paper presents a solution for toolpath optimisation using a combination of Ant Colony Optimisation (ACO) and Particle Swarm Optimisation (PSO) algorithms. The toolpath optimization problem is represented as a Traveling Salesman Problem (TSP) and specifically addresses it as a Sequential Ordering Problem (SOP). This formulation allows for a more structured approach to managing the sequence of toolpaths, ensuring optimal order and transitions. The proposed approach leverages the strengths of both algorithms to enhance the efficiency of toolpath planning in complex machining operations with fixed and flexible toolpath orders. The study investigates the effectiveness of this created algorithm in handling these complex operations represented as multiple vectors of varying states and orientations. Extensive simulations and real-world experiments are done to demonstrate improvement gains in toolpath optimization and reduction of machining time. The results indicate a significant improvement in toolpath optimization compared to using traditional toolpath optimisation.

Keywords: Ant Colony Optimization, Particle Swarm Optimisation, Traveling Salesman Problem, Sequential Ordering Problem, Computational Speed Analysis

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DEDICATION

This paper is dedicated to my family and friends for their unwavering support and encouragement. Many thanks also to my mentors and colleagues, whose guidance and insights have been invaluable.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my Advisor, Dena Hendriana B.Sc. S.M. Sc.D, for their continuous support, and immense knowledge. I also extend my thanks to my Co-Advisor, Dr. Ir. Hanny J. Berchmans M.T. M.Sc., for thier insight and willingness to help. I am also thankful to my colleagues for their time, discussions and suggestions. Finally, my deepest appreciation goes to my family for their endless love and encouragement throughout this journey.

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