A Novel Method Based on Deep Learning for Hole Group Machining Process Path Optimization

1st Chen Jinping
School of Mechanical Engineering
Zhengzhou University of Aeronautics
Zhengzhou, China
nnsfcjp@zua.edu.cn

2nd Tu Yiliu
Department of Mechanical and Manufacturing Engineering
University of Calgary
*Calgar*y, Canada
paultu@ucalgary.ca

3rd Chen Jing
School of Foreign languages
Zhengzhou University of Aeronautics
Zhengzhou, China
Chenjing_130@163.com

4th Sha Quanyou
School of management Engineering
Zhengzhou University of Aeronautics
Zhengzhou, China
qysha@zua.edu.cn

5th Yin Xin
School of Mechanical Engineering
Zhengzhou University of Aeronautics
Zhengzhou, China
yinxin6688@126.com

6th Guo Shiyi
School of Mechanical Engineering
Zhengzhou University of Aeronautics
Zhengzhou, China
2590204499@qq.com

7th Feng Xianzhang
School of Mechanical Engineering
Zhengzhou University of Aeronautics
Zhengzhou, China
phdfxz@163.com

8th Zeng Fanguang
School of Materials Science and Engineering
Zhengzhou University of Aeronautics
Zhengzhou, China
fgzeng@sina.com

***Abstract*—Hole group machining is a critical operation in modern manufacturing, and its tool path optimization plays a key role in improving efficiency, reducing costs, and ensuring product quality. Traditional methods for tool path optimization rely on heuristic algorithms or manual intervention, which are often time-consuming and sub-optimal for complex workpieces. This paper proposes a novel deep learning-based method for optimizing the machining process path for hole group processing. A deep learning framework is built. A deep learning-based process optimization experiment for hole group machining is carried out. By using advanced neural network architectures and reinforcement learning techniques, the proposed method achieves significant improvements in path efficiency, reduces non-cutting movements, and enhances tool lifespan. The experimental results demonstrate that the method proposed in this paper can effectively improve the efficiency.**

Keywords—hole group machining, deep learning, tool path, optimization, efficiency