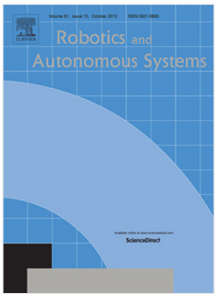
Accepted Manuscript



Approximate optimal method for cyclic solutions in multi-robotic cell with processing time window

Zhu Wang, Binghai Zhou, Damien Trentesaux, Abdelghani Bekrar

PII: S0921-8890(17)30404-9
DOI: https://doi.org/10.1016/j.robot.2017.09.020
Reference: ROBOT 2922

To appear in: *Robotics and Autonomous Systems*

Received date : 13 June 2017
Revised date : 1 September 2017
Accepted date : 26 September 2017

Please cite this article as: Z. Wang, B. Zhou, D. Trentesaux, A. Bekrar, Approximate optimal method for cyclic solutions in multi-robotic cell with processing time window, *Robotics and Autonomous Systems* (2017), https://doi.org/10.1016/j.robot.2017.09.020

Approximate optimal method for cyclic solutions in multi-robotic cell with processing time window

Zhu WANG, Binghai ZHOU*, Damien TRENTESAUX, Abdelghani BEKRAR

This paper studies a robotic cell in which multiple single-armed robot manipulators are equipped for transporting parts between the machines. Compared with most previous studies, processing time window is considered in this paper, i.e. identical parts are processed successively on multiple machines with upper and lower bounds on processing times. The problem discussed in this paper aims at finding optimal cyclic solution for the robot, that is, a sequence of robot moves that can be repeated endlessly and that can achieve the goal of minimum cycle time. Based on the description and analysis, the problem is formulated as a mixed-integer programming model with the objective of minimizing the cycle time. The commercial software CPLEX is used to solve the proposed model. This paper also presents a relaxed mathematical model to compute the lower bound of cycle time. In order to be more efficient, a model-based heuristic algorithm is constructed. Computational experiments on benchmark and randomly generated instances validate the feasibility and efficiency of the proposed heuristic algorithm.

Keywords: cyclic solution; robotic cell; optimization; processing time window; mixed integer programming; heuristic algorithm

Zhu WANG
School of Mechanical Engineering, Tongji University, Shanghai, China
LAMIH, UMR CNRS 8201, University of Valenciennes and Hainaut-Cambrésis, Valenciennes, Nord, France
2011wangzhu@tongji.edu.cn

Binghai ZHOU*
School of Mechanical Engineering, Tongji University, Shanghai, China
bhzhou@tongji.edu.cn
*Corresponding author

Damien TRENTESAUX
LAMIH, UMR CNRS 8201, University of Valenciennes and Hainaut-Cambrésis, Valenciennes, Nord, France
Damien.trentesaux@univ-valenciennes.fr

Abdelghani BEKRAR
LAMIH, UMR CNRS 8201, University of Valenciennes and Hainaut-Cambrésis, Valenciennes, Nord, France
Abdelghani.bekrar@univ-valenciennes.fr