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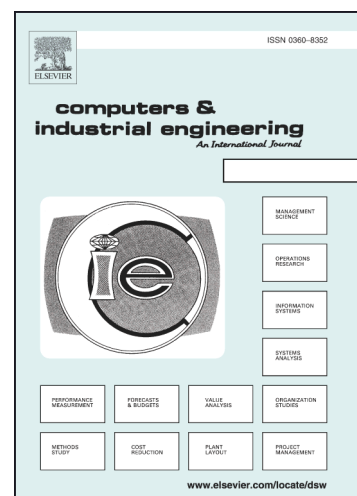
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# Stochastic scheduling of an automated two-machine robotic cell with in-process inspection system

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## Abstract

This study is focused on the domain of a two-machine robotic cell scheduling problem for three various kinds of pickup scenarios: free, interval, and no-wait pickup scenarios. Particularly, we propose the first analytical method for minimizing the partial cycle time of such a cell with a PC-based automatic inspection system to make the problem more realistic. It is assumed that parts must be inspected in one of the production machines, and this may result in a rework process. The stochastic nature of the rework process prevents us from applying existing deterministic solution methods for the scheduling problem. This study aims to develop an in-line inspection of identical parts using multiple contact/non-contact sensors. Initially, we convert a multiple-sensor inspection system into a single-sensor inspection system. Then, the expected sequence times of two different cycles are derived based on a geometric distribution, and finally the maximum expected throughput is pursued for each individual case with free pickup scenario. Results are also extended for the interval and no-wait pick up scenarios as two well-solved classes of the scheduling problem. The waiting time of the part at each machine after finishing its operation is bounded within a fixed time interval in cells with interval pickup scenario, whereas the part is processed from the input conveyor to the output conveyor without any interruption on machines in cells with no-wait pickup scenario. We show a simple approach for solving these two scenarios of the problem which are common in practice.

*Keywords:* Scheduling, Rework, Robotic cell, Performance

## 1 Introduction

Robotic cells are one of the complicated application areas of flow-shops that have received a considerable amount of attention in different areas such as robot path planning [1, 2], robot selection [3, 4], task allocation in robotic systems [5] and robot move sequencing [6, 7]. They are basically classified into two categories: the robotic cells without rework assumption and robotic rework cells.

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