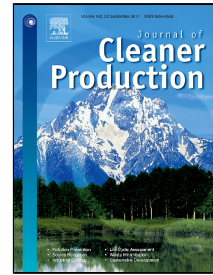


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# Game theory based real-time multi-objective flexible job shop scheduling considering environmental impact

Yingfeng Zhang<sup>a,\*</sup>, Jin Wang<sup>a</sup>, Yang Liu<sup>b,c,\*</sup>

<sup>a</sup> Key Laboratory of Contemporary Design and Integrated Manufacturing Technology, Ministry of Education, Northwestern Polytechnical University, Shaanxi, P.R.China, 710072

<sup>b</sup> Department of Management and Engineering, Linköping University, SE-581 83 Linköping, Sweden

<sup>c</sup> Department of Production, University of Vaasa, PL 700, 65101 Vaasa, Finland

**Abstract:** Production scheduling greatly contributes to optimising the allocation of processes, reducing resource and energy consumption, lowering production costs and alleviating environmental pollution. It is an effective way to progress towards green manufacturing. With the extensive use of the Internet of Things in the manufacturing shop floor, a huge amount of real-time data is created. A typical challenge is how to achieve the real-time data-driven optimisation for the manufacturing shop floor to improve energy efficiency and production efficiency. To address this problem, a dynamic game theory based two-layer scheduling method was developed to reduce makespan, the total workload of machines and energy consumption to achieve real-time multi-objective flexible job shop scheduling. To obtain an optimal solution, a sub-game perfect Nash equilibrium solution was designed. Then, a case study was employed to analyse the performance of the proposed method. The results showed that the makespan, the total workload of machines and energy consumption were reduced by 4.5%, 8.75%, and 9.3% respectively. These improvements can contribute to sustainable development and cleaner production of manufacturing industry.

**Keywords:** Real-time data, Multi-objective, Flexible job shop scheduling, Dynamic game theory

## 1. Introduction

Nowadays, manufacturing, as the backbone of an industrialised society while struggling for sustainable competitive advantage (Liu, 2013; Liu and Liang, 2015), is facing other growing

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\*Corresponding authors.

E-mail addresses: zhangyf@nwpu.edu.cn (Yingfeng Zhang), yang.liu@liu.se (Yang Liu).

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